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CYCLONE/COAL TIMBER HARVEST PROJECT

August 1998

Draft Environmental Impact Statement

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ABBREVIATIONS

3A-Authorization	A short term exemption from Montana's surface water quality standards
124 Permit	Stream Preservation Act Permit
BLM	Bureau of Land Management
BMP	Best Management Practices
BMU	Bear Management Unit
DBH	Diameter at breast height
DEIS	Draft Environmental Impact Statement
DEQ	Montana Department of Environmental Quality
DFWP	Montana Department of Fish, Wildlife and Parks
DNRC	Montana Department of Natural Resources and Conservation
ECA	Equivalent Clearcut Acres
EIS	Environmental Impact Statement
FEIS	Final Environmental Impact Statement
FI	Forest Improvement
FNF	Flathead National Forest
FRTA	National Forest Roads and Trails Act
FY	Fiscal year
GIS	Geographic Information System
ICRB	Interior Columbia River Basin Project
ID Team	Interdisciplinary team
IGBC	Interagency Grizzly Bear Committee
MBF	Thousand Board Feet
MCA	Montana Code Annotated
MEPA	Montana Environmental Policy Act
MMBF	Million Board Feet
NCDE	Northern Continental Divide Ecosystem (Grizzly Bear Recovery Area)
ORD	Open Road Density
OSHA	Office of Safety and Health Administration
SFLMP	State Forest Land Management Plan
SLI	Stand Level Inventory
SMZ	Streamside Management Zone
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service

INTER OFFICE MEMO

To: Patcharin Williams
Montana State Library

From: Carole Massman cm
Department of Natural Resources and Conservation

Subject: Cyclone/Coal Timber Harvest Project - Draft EIS

Date: August 28, 1998

Here are four copies of inserts to the Draft EIS on the Cyclone/Coal Timber Harvest Project. I just sent four copies of the EIS itself to you via deadhead mail earlier today, before the inserts arrived. Please add one copy of the enclosed insert to each copy of the EIS before distributing the EISs to the Montana State Library, Montana Historical Society, University of Montana, and Montana State University.

Thank you.

stabilize, there would be a long-term benefit to fish habitat by the elimination of long-term and chronic sources of sediment.

Fisheries monitoring would continue annually through the duration of the deferral and for at least 1 year after completion of this analysis. At that time, management direction determined by the analysis would determine the need for further monitoring of fish habitat in Cyclone Creek. Monitoring of fish habitat in Coal Creek by MFWP would continue as part of the Coal/Flathead River Basin Monitoring Study.

AIR QUALITY

EFFECTS OF ALTERNATIVE A AND F

Alternative A and F would not create impacts over existing levels to air quality.

EFFECTS OF ALTERNATIVES B, C, D, AND E

Log hauling and related traffic on dry roads may increase the amount of road dust. Burning logging residue would produce particulate matter. The smoke column generated by burning would likely reach Glacier National Park, but is not expected to reach populated areas in the park or in Flathead County. The stipulations and specification listed for air quality in Appendix A should prevent road dust from impacting populated areas and limit the impacts from burning to levels not exceeding EPA/State/County/local standards.

CUMULATIVE EFFECTS

Air quality cumulative effects would not exceed the levels defined by the State of Montana Cooperative Smoke Management Plan (1988) and managed by the Montana Airshed Group.

FISHERIES

Sedimentation generated by proposed timber-harvesting activities has the potential to adversely affect the quality of bull trout and westslope cutthroat trout habitat. Sedimentation, a fisheries-related issue, is discussed in the watershed portion of this document.

EFFECTS OF ALTERNATIVE A

Fisheries habitat would remain essentially unchanged. Sediment sources would not be remedied under the sale proposal. Changes in fish-habitat quality would occur as a result of natural and preexisting conditions. Monitoring of fisheries habitat by DNRC would be discontinued for Cyclone Creek until future projects presented the need for additional data. The monitoring of fish habitat in Coal Creek by DFWP would continue as part of the Coal/Flathead river Basin Monitoring Study.

EFFECTS OF ALTERNATIVES B, C, D, AND E

As agreed to in the immediate actions for bull trout recovery recommended by the Scientific Group, none of the action alternatives would propose harvesting in an SMZ containing a bull trout stream. Cutting unit boundaries have been proposed well away from SMZ boundaries in all of the action alternatives. Each of these action alternatives would replace the Dead Horse bridge over Coal Creek and install surface-drainage and erosion-control features on approximately 32 miles of existing road, so all roads meet current BMP standards as a minimum. These activities would lead to short-term increases in sedimentation during construction. The short-term increases may lead to deposition of fine sediment in spawning and rearing areas. As the sites revegetate and stabilize, there would probably be a long-term benefit to fish habitat by the elimination of long-term and chronic sources of sediment.

All proposed harvest activities present a low risk of impact to fisheries habitat or populations due to implementation of BMPs, the SMZ law, Immediate Actions for Bull Trout Restoration, and the Flathead Basin Forest Practices Water Quality and Fisheries Cooperative recommendations.

Fisheries monitoring in Cyclone Creek would continue annually through the duration of the project and for at least 1 year after project completion under each of these action alternatives. The monitoring of fish habitat in Coal Creek by MFWP would continue as part of the Coal/Flathead River Basin Monitoring Study.

EFFECTS OF ALTERNATIVE F

The effects of Alternative F on fisheries habitat would be similar to the effects described under Alternative A. Under Alternative F, no timber harvesting would take place until a larger analysis area (North Fork) could be analyzed to assess values found in Coal Creek State Forest. Alternative F would complete all of the road improvements and the bridge replacement as described in the previous section. These activities would lead to short-term increases in sedimentation during construction. As the sites revegetate and

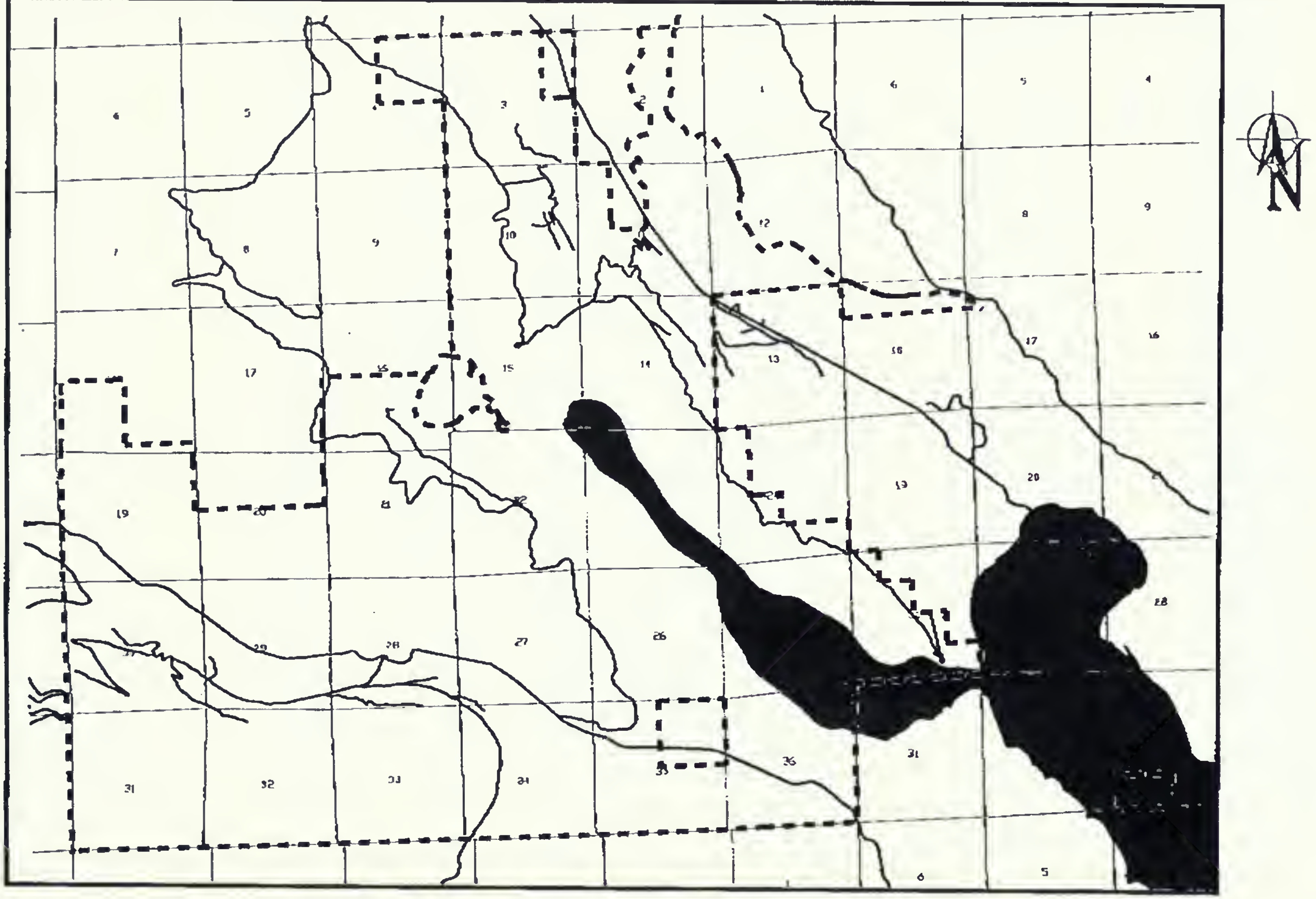
Figure III-14
Cyclone/Coal Timber Harvest Project
Mule Deer Winter-Range Map

LEGEND

Existing Roads ———

Project Area Boundary - - - - - - -

Mule Deer Winter-Range ■



DEPARTMENT OF
NATURAL RESOURCES AND CONSERVATION

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August 25, 1998

RE: Cyclone/Coal timber Harvest Project Draft Environmental Impact Statement
Corrections

Enclosed is the Mule Deer Winter Range Map, Figure III-14, of this DEIS. This map should replace page III-44, the first of two White-tailed Deer Winter Range Maps.

Also, the Fisheries and Air Quality sections were inadvertently deleted from Chapter IV. Please insert these pages after the Watershed section, page IV-50.

Sincerely,
Brian Manning for Bob Sandman
Robert L. Sandman
Stillwater Unit Manager

RLS:mb
cc: DEIS holders
Cyclone/Coal project file

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"AN EQUAL OPPORTUNITY EMPLOYER"

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SUMMARY

DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR THE CYCLONE/COAL PROPOSED TIMBER SALE

INTRODUCTION AND DESCRIPTION OF THE PROPOSED ACTION

The Department of Natural Resources and Conservation (DNRC), Stillwater Unit proposes to harvest timber in Coal Creek State Forest to generate revenue for the Montana School Trust. The project area is located approximately 2 miles south of Polebridge, Montana, and includes the entirety of 20 sections and portions of 9 sections in T34N, R21W, and T33N, R22W, for a total of 15,060 acres, approximately (see Figure I-1, page 2). If a harvest alternative is selected, 712 to 1,216 acres would be harvested with various silvicultural treatments.

PROJECT NEED

In 1996, DNRC adopted and released the Record of Decision on the State Forest Land Management Plan (SFLMP). The State Board of Land Commissioners approved implementation of the SFLMP on June 17, 1996. The SFLMP outlines DNRC's management philosophy for forested State trust lands and sets out specific Resource Management Standards for 10 resource categories. The SFLMP states:

> ***Our premise is that the best way to produce long-term income for the trust is to manage intensively for healthy and biologically diverse forests. Our understanding is that a diverse forest is a stable forest that will produce the most reliable and highest long-term revenue stream... In the foreseeable future, timber management will continue to be our primary source of revenue and our primary tool for achieving biodiversity objectives.***

The lands involved in this proposed project are held by the State of Montana in trust for the support of specific beneficiary institutions, such as public schools, *Enabling Act of February 22, 1889; 1972 Montana Constitution, Article X, Section 11*. The Board of Land Commissioners and DNRC are required by law to administer trust lands to produce the largest measure of reasonable and legitimate return over the long run for these beneficiary institutions, *Section 77-1-202, Montana Codes Annotated* (MCA).

PROJECT OBJECTIVES

The Cyclone/Coal Timber Sale must produce the largest measure of reasonable and legitimate return to the trust in the long run. The sale would also provide a sufficient amount of sawlog volume to contribute to the sustained yield for DNRC as mandated by State Statute 77-5-222, MCA.

The project would move the forest toward the desired future conditions characterized by the proportion and distribution of forest types and structures historically present on the landscape.

AFFECTED ENVIRONMENT

The Cyclone/Coal proposed timber harvest area is located in Coal Creek State Forest, which is west of Glacier National Park, approximately .75 miles south of Polebridge, and 23 miles north of Columbia Falls (Figure I-2, page 5). The project area is located in the Cyclone and Coal watersheds and the State Coal Cyclone Grizzly Bear Management Subunit.

The project covers 15,060 acres and ranges in elevation from 3,710 feet, where Coal Creek leaves the project area, to the 6,766-foot Coal Ridge, located on the western boundary of Coal Creek State Forest. The project area consists of steep canyons, limited access, avalanche chutes, heavily timbered slopes, subalpine terrain, and riparian areas along Coal and Cyclone creeks and the small feeder streams. No major activity has occurred in the project area for the past 11 years.

The project is bordered on the north, south, and west by Flathead National Forest (FNF) lands. The eastern boundary is bordered by Glacier National Park, the North Fork of the Flathead River, and private lands. The project area is colored blue on USFS maps and marked as Coal Creek State Forest.

EIS DEVELOPMENT

The EIS was prepared in compliance with the Montana Environmental Policy Act (MEPA). MEPA requires State government to include consideration of environmental impacts in its decisionmaking process. It also requires agencies to inform the public and other interested parties of the proposed projects, environmental impacts that might result, and alternative actions that could achieve project objectives.

PUBLIC CONCERNS

The initial stage of an EIS is the public scoping process, which is used to inform the public that a State agency is proposing an action and gather comments on the possible impacts of the project. The scope of this EIS was determined by the professional judgement of resource specialists in DNRC and other State and Federal agencies and comments from the public and other interested parties.

DNRC solicited public participation in the Cyclone/Coal timber harvest project on January 10, 1997, by distributing a letter and the initial project proposal to individuals, landowners, organizations, industries, and agencies. As the project continued, interested parties were updated during open houses in April, 1997; a field tour on October 3, 1997; and 4 newsletters at critical points during the development of the project that requested additional input from the public.

The project was advertised in Kalispell's Daily Interlake Newspaper and Columbia Falls' weekly Hungry Horse News. Comments on the project were accepted through December 31, 1997.

The mailing list of parties interested in the project is located in Appendix A. Public scoping comments are summarized in chapter II; the original comments are located in the project file at the Stillwater Unit Office, Olney.

CONCERNS RAISED DURING SCOPING

Through the scoping process, concerns were raised by the public and specialists of DNRC and other agencies about the project's potential impacts on the environment. These concerns were used in developing the alternatives (see Chapter II). A summary of the comments that were incorporated into the alternatives is presented below.

VEGETATION

ECOSYSTEM CHARACTERISTICS

Concerns were raised that:

- Timber harvesting would reduce the total area of forest.
- Timber harvesting could alter the ecological characteristics of forested stands in the project area.
- Timber harvesting may reduce the structural and compositional diversities that stands require to function as natural ecosystems.
- Existing stands may be fragmented.
- Edge effects may increase beyond levels acceptable for the maintenance of natural biological diversity.
- Coal Creek State Forest is lacking in early successional forests.
- Seral or intolerant cover types are not represented in proper proportions in the landscape that would historically be expected.
- There is a loss of western white pine on the landscape due to white pine blister rust.
- Fire hazard is extreme due to the amount of dead and down woody debris on the forest floor caused by stagnant lodgpeole pine stands.

OLD GROWTH

Concerns were raised that:

- The character of old-growth stands in the project area might be significantly altered, and the connections of those stands with adjacent old-growth stands could be affected.

- Timber harvesting may ruin the opportunity to use existing old-growth stands as "natural areas" where the ecological uniqueness of old-growth forests could be maintained.
- The amount, distribution, connectivity, and character of the old-growth timber stands in Coal Creek State Forest may be changed by the harvesting within them.
- A lack of development and implementation by DNRC for a long-term, old-growth management strategy exists.
- Old-growth-dependent species may become locally extinct.
- All existing old growth should be maintained due to the lack of a long-range plan for the old-growth stands in Coal Creek State Forest.

TIMBER VALUE

Concerns were raised that:

- Timber sales would no longer support school trusts if the cost of preparation outweighs the returns to the trusts.
- Timber stands should be managed to provide for long-term health and productivity.
- Timber harvesting should be done so the full diversity of structural components, genetic variation, and species mix is maintained in these stands.

WILDLIFE

Cumulative impacts, including past, present, and antcipated future effects, to threatened and endanagered, old-growth-associated, sensitive, cavity-dependent, and big game species was a concern.

GRIZZLY BEAR (THREATENED SPECIES)

Concerns were raised that:

- Road densities would increase.
- Bears could be displaced from seasonal habitats.
- Travel corridors could be disrupted.
- Core or security areas could be reduced

OLD-GROWTH-ASSOCIATED SPECIES

Concerns were raised that old-growth blocks of sufficient size to support these species, with corridors between, would not be retained.

CAVITY-DEPENDENT WILDLIFE

Concerns were raised that:

- Useable snags of suitable size and species would not be retained.
- Allowance would not be made for the replacement of existing snags over time.
- The populations of cavity-dependent wildlife species would be reduced in the project area.

BIG GAME

Concerns were raised that:

- Timber harvesting could harm elk and white-tailed deer populations.
- Tree removal may reduce the availability of hiding and thermal cover.
- Road construction and improvement may reduce security by increasing the vulnerability of white-tailed deer and elk to hunters.
- Harvesting timber in moist sites could ruin moose and elk habitat.

BALD EAGLE AND COMMON LOON HABITATS

Concerns were raised that:

- Bald eagles and common loons would be displaced from their seasonal habitats and security areas.
- The flight patterns of eagles and common loons would be disturbed.

GRAY WOLF (THREATENED SPECIES)

Concerns were raised that wolves would be displaced from their seasonal habitats and security areas.

FISHERIES

Concerns were raised that bull and westslope cuthroat trouts may be harmed if water quality is adversely affected in the Cyclone and Coal drainages.

WATER QUALITY

Concern was expressed that timber harvesting or road construction may add sediment and increase runoff to the Cyclone and Coal drainages, causing adverse effects to water quality and fisheries habitat.

SOIL

Concern was expressed that timber harvesting might cause soil rutting, compaction, displacement, and loss of productivity.

NOXIOUS WEEDS

Concerns were raised that:

- Weeds have increased rapidly on school trust lands, in particular, where timber harvesting has taken place.
- Weeds would be introduced and spread where timber harvesing is proposed.

ALTERNATIVE MANAGEMENT

Concerns were raised that:

- Management guidelines for resources other than timber, described in the SFLMP, were compromised due to the expected volume needed from State trust lands and, specifically, Coal Creek State Forest.
- Because of this compromise, biodiversity would not be maximized.
- A cooperative agreement lease should be used emphasizing other resource needs that would reimburse the State trusts for any money loss due to the change of management criteria. A 2-year deferral will be analyzed as an alternative for this project.

CULTURAL RESOURCES

Concerns were raised that timber harvesting might cause irreparable harm to any historical or archaeological resources in the project area.

A DNRC archaeologist examined the project area for historical or archaeological resources, but found none. Mitigating measures would be implemented if archaeological resources were found during further examination or during project activities (see Appendix B, Stipulations and Specifications, under Archaeology).

LAND EXCHANGE

Concerns were raised that due to the sensitive nature of Coal Creek State Forest, DNRC management opportunities are limited. Therefore, Coal Creek State Forest should be exchanged for other lands that may be more suitable to the DNRC timber-management program.

DEVELOPMENT OF ALTERNATIVES

An interdisciplinary team (ID team) was formed to work on the project. The role of the ID team was to develop the project and analyze potential impacts on the human and natural environment. The development of alternatives began in January, 1997, when DNRC developed a project proposal describing the proposed action and project time line. The proposal was sent to interested members of the public, adjacent landowners, and other State and Federal agencies for review. Comments were accepted for a 30-day period. Newsletters were sent out during important stages of the project to keep interested parties informed. Input was requested throughout the life of the project.

The ID team reviewed comments received and used them to develop 4 timber-harvesting alternatives, a deferral-type alternative, and a no-action alternative.

DESCRIPTION OF ALTERNATIVES

ACTIONS COMMON TO ALL ALTERNATIVES

The following actions would be implemented under all the alternatives:

- Ensure seasonal closure of the road leading to Cyclone Lake during nesting seasons for eagles and loons (winter and spring months).
- Due to structural failure and the potential for sediment entering Coal Creek, replace the Dead Horse Bridge that crosses Coal Creek.
- Bring roads that are under a cooperative agreement with USFS up to BMP standards.
- Treat noxious weeds in accordance with the Flathead County Weed Plan.
- Cooperatively with MDFWP, build, erect, and periodically maintain a floating sign regarding loon nesting and nursery areas.
- Erect and maintain a gate and signs indicating only nonmotorized recreational traffic is allowed on the trail leading toward Cyclone Lake.

NO-ACTION ALTERNATIVE - ALTERNATIVE A

If Alternative A, the No-Action Alternative, were selected, none of the action alternatives would be implemented. Current management activities, such as fire suppression and road maintenance, would continue. The Dead Horse Bridge would be replaced. The natural progression of cover types toward more shade-tolerant species, such as subalpine fir and spruce, would continue. Following the appropriate level of MEPA review, other land management activities, such as timber harvesting, could be proposed and undertaken in the future. Figure II-1 shows the project area as it would continue to exist under Alternative A. The No-Action Alternative can be used as a baseline for comparing the environmental consequences of the 4 timber-harvesting alternatives and is considered a viable alternative for selection.

TIMBER-HARVESTING ALTERNATIVES - ALTERNATIVES B THROUGH E

The ID Team developed timber-harvesting alternatives based on an analysis of forest stand conditions. Proposed treatments would move the forest toward desired future conditions on the landscape. Three primary concepts were used to differentiate between alternatives:

- The western larch/Douglas-fir and western white pine cover types were determined to be the most underrepresented cover types on Coal Creek State Forest. Each action alternative would increase the proportion of the western larch/Douglas-fir and western white pine cover types, but in a different way.
- The large contiguous blocks of old growth were determined to be important components of the landscape on the Coal Creek State Forest. Each action alternative would affect the old-growth blocks in a different way.

- There is potential for establishment of a natural area in the future due to the distinctive resource qualities of portions of Coal Creek State Forest. The alternatives address these areas in different ways.

ALTERNATIVES B AND D

Alternative B would harvest approximately 10.6 million board feet (MMBF) from 931 acres in 7 units. Alternative D is the same as Alternative B, except that Unit 1 is excluded. Alternative D would harvest approximately 9.8 MMBF from 699 acres in 6 units (see Figure II-3). Under Alternative B and D approximately .25 mile of new road may be built to access Section 14.

Alternatives B and D increase the proportions of the western larch/Douglas-fir and western white pine cover types by replacing existing mixed-conifer stands with regenerated young western larch/Douglas-fir and western white pine stands. This approach would limit the old growth entered by a concentrated harvest on a limited number of acres. Connectivity between old-growth stands would be maintained by not entering connecting stands.

Alternative D is the same as Alternative B, except that it incorporates the concern that was expressed during alternative development regarding the distinctive qualities (bald eagle nest, common loon nest, and grizzly bear core area) found in the Cyclone Lake drainage. Unit 1 is within the basin and visible from Cyclone Lake and other areas. By not harvesting in Unit 1, the potential to be designated as a "natural area" would be maintained in the future.

Treatment of Unit 1 (Alternative B)- Approximately 35% of Unit 1 would receive the seedtree with reserves treatment; the remaining 65% would have a shelterwood treatment. This unit was selected for this treatment due to the mortality occurring on this southwesterly slope from root rot fungus (*Armillaria*, spp.) The treatment acknowledges the long-term presence of root rots; thus, rather than eradicating root rots, the natural mortality is being salvaged. Over the long term, some gain in genetic resistance may be achieved through the harvest prescription, but root rot will probably always be present at some level. Due to ponderosa pine's greater resistance to root rots, the planting of ponderosa pine is expected to reduce the long-term mortality in this unit.

TABLE II-1 - ALTERNATIVES B AND D UNIT TREATMENTS

UNIT #	TOTAL ACRES	TREATMENT	HARVEST METHOD	HARVEST VOLUME (MBF)	HAZARD REDUCTION/SITE PREPARATION	REGENERATION
Unit 1 applies to Alternative B only:						
1	232	STR/SH	Helicopter	810	Broadcast-jackpot burn/hand scalp	Plant ponderosa pine
Units 2 through 7 apply to both Alternatives B and D:						
2	218	CCR/SH	Soft track/ tractor	5,232	Broadcast-jackpot burn	Plant western white pine and western larch
3	36	CCR/STR	Tractor	324	Machine pile and scarify	Plant ponderosa pine and western larch
4	21	STR/SH	Tractor	168	Machine pile and scarify	Plant western white pine and western larch
5	200	CCR/SH	Cable, helicopter, and soft track	3,002	Broadcast/jackpot burn and machine pile	Plant western white pine and western larch
6	62	STR	Tractor	310	Machine pile and scarify	Plant western white pine and western larch
7	162	CCR	Tractor	805	Broadcast/jackpot burn	Natural
Alternative B Totals	931			10,651		
Alternative D Totals	699			9,841		

STR - seedtree with reserves
CCR - clearcut with reserves
STR/SH - seedtree with reserves with some areas of additional shelterwood retention
CCR/SH - clearcut with reserves with some areas of additional shelterwood retention
CCR/STR - clearcut with reserves with some areas of additional seedtree with reserves

ALTERNATIVES C AND E

Alternative C would harvest approximately 9.5 MMBF from 1,226 acres in 7 units. Alternative E is the same as Alternative C, except Unit 1 is excluded. Alternative E would harvest approximately 8.9 MMBF from 994 acres in 6 units (see Figure II-4). Under Alternative C and E approximately .25 mile of new road may be built to access Section 14.

Alternatives C and E increase the proportions of the western larch/Douglas-fir and western white pine cover types by removing encroaching midlevel and understory mixed conifer trees in existing western larch/Douglas-fir and western white pine stands. This approach would enter old-growth stands, but retain large old trees, large snags, and concentrations of down woody material. Multiple canopy layers and associated old-growth attributes would redevelop as shade-tolerant species regenerate in the future. Connectivity between old-growth stands would be maintained by retaining these old-growth characteristics in the stands.

Alternative E is the same as Alternative C, except that it incorporates the concern expressed during alternative development regarding the distinctive qualities (bald eagle nest, common loon nest, and grizzly bear core area) found in the Cyclone Lake drainage. Unit 1 is within the basin and visible from Cyclone lake and other areas. By not harvesting in Unit 1, the potential for that area to be designated as a "natural area" would be maintained in the future.

Treatment of Unit 1 (Alternative C) - Approximately 25% of the unit would receive the seedtree with reserves treatment. The remaining 75% would receive a shelterwood treatment. Unit 1 was selected for this treatment because of the mortality occurring due to root rot fungus on this southwesterly slope. This treatment acknowledges the long-term presence of root rots; thus, rather than eradicating root rot, the natural mortality would be salvaged. Over the long term, some gain in genetic resistance may be achieved through our harvest prescription, but root rot will probably always be present at some level. No planting would occur in this unit; instead, the development of naturally resistant Douglas-fir would be relied upon.

TABLE II-2- ALTERNATIVES C AND E UNIT TREATMENTS

UNIT #	TOTAL ACRES	TREATMENT	HARVEST METHOD	HARVEST VOLUME (MBF)	HAZARD REDUCTION/SITE PREPARATION	REGENERATION
Unit 1 applies to Alternative C only:						
1	232	STR/SH	Helicopter	580	Broadcast/ jackpot burn	Natural
Units 2 through 7 apply to both Alternatives C and E:						
2	218	TFB/STR	Soft track/ tractor	2,830	Broadcast/ jackpot burn	Plant western white pine and western larch
3	36	CCR/STR	Tractor	324	Machine pile and scarify	Plant ponderosa pine and western larch
4	21	STR/SH	Tractor	168	Machine pile and scarify	Plant western white pine and western larch
5	495	CCR/SH	Cable, helicopter, and soft track	4,455	Broadcast/jack pot burn and machine pile	Plant western white pine and western larch
6	62	STR	Tractor	310	Machine pile and scarify	Plant western white pine and western larch
7	162	CCR	Tractor	805	Broadcast/jack pot burn	Natural
Alternative C Totals	1,226			9,472		
Alternative E Totals	994			8,892		

STR - seedtree with reserves
CCR - clearcut with reserves
TFB/STR - thinning from below with some openings having seedtrees with reserves
STR/SH - seedtree with reserves with some areas of additional shelterwood retention
CCR/SH - clearcut with reserves with some areas of additional shelterwood retention
CCR/STR - clearcut with reserves with some areas of additional seedtree with reserves

DEFERRAL ALTERNATIVE - ALTERNATIVE F

Alternative F would defer timber management in the project area for 2 years, during which time a wider area of analysis in the North Fork of the Flathead drainage would be performed by Montana Department of Fish Wildlife & Parks (DFWP) and The Nature Conservancy (TNC) in conjunction with DNRC to determine and analyze the full range of resource values that exist on Coal Creek State Forest. During the two-year deferral, the trust would be compensated by the interested parties. Following the two-year deferral, several options would exist, including:

- entering into a cooperative private-public partnership to manage Coal Creek State Forest;
- to produce reasonable and legitimate income (including timber management),while giving preference to specific resource values;
- agreeing to defer or manipulate only certain areas of Coal Creek State Forest to meet agreed upon objectives;
- pursuing other forms of cooperative management; or
- returning exclusively to DNRC management.

HOW TO ACCOMPLISH

A 2-step decision process would be needed to implement Alternative F. The initial decision would be to defer a timber-harvesting alternative in order to pursue the development of this proposed management strategy. If that decision is made, a second decision would be required to adopt or reject whatever proposals are developed during the 2-year planning period.

- Step 1 - This alternative would allow interested parties to purchase the right to jointly develop a management strategy over a 2-year period by deferring the proposed timber harvest. They would pay the expected amount of money to the trust that would be received if another action alternative was selected and the timber sold.

During the deferral period, the Nature Conservancy and DFWP would cooperate with DNRC to determine the resources to be managed, how they would be managed, and the comparison of the values generated from Alternative F as compared to managing strictly under the SFLMP. The Nature Conservancy, possible other interested parties, and/or DFWP would fund an analysis of a wider area to determine the value of the Coal Creek State Forest timber stands and the management strategies to be applied. For example, characteristics, such as old growth, that contribute to the overall natural life cycle of the forest located in the North Fork drainage, but differ from guidelines set by the SFLMP, would need to be designated for management by the State Land Board.

Since a cooperative management strategy may not use typical management practices on State forest land, DNRC would need to determine during the deferral period the methodology, responsibilities, and legal examples for this type of agreement. The agreement would develop a long-term partnership between DNRC and private individuals or organizations. DNRC would determine the amount of money lost to the trust using Alternative F compared to the management strategy found in the SFLMP. Alternative F would reimburse the trust for the difference, as well as fund other opportunities to manage the natural resources not stated in the SFLMP.

- Step 2 - Following the initial deferral period and acquiring the results of the wider analysis area, the second decision would be made. The results listed below, and others not thought of, could be adopted:
    - A long-term cooperative management agreement for the entire Coal Creek State Forest with the Nature Conservancy, DFWP, and, potentially, other entities.
    - Agreements that postpone or manipulate certain areas of Coal Creek State Forest to meet the Nature Conservancy or Hungry Horse Wildlife Mitigation Fund goals.
    - Recommendations for pursuing other forms of cooperative management.

- Exclusive DNRC management. This may mean:
    - implementing one of the timber-harvesting alternatives for this project;
    - proposing new projects;
    - adopting a different overall strategy based on the results of the analysis;
    - meeting the cooperators' objectives under the SFLMP without additional management agreements and their associated costs;
    - not reaching an agreement; or
    - funding from the cooperators was lacking.

STATUS OF ALTERNATIVE F

Since Alternative F was analyzed, DFWP informed DNRC that funding from their sources would not be available for implementation of this alternative, making DNRC unable to select this alternative. DFWP would still like to work with DNRC to cooperatively develop this alternative management philosophy in the future.

PERMITS REQUIRED TO IMPLEMENT THE PROJECT

- A Stream Preservation Act Permit (124 Permit) is required from DFWP for activities that could affect any fisheries stream.
- A short-term exemption from Montana's Surface Water Quality Standards (3A-Authorization) is required whenever activities introduce sediment above natural levels into live streams. This Department of Environmental Quality (DEQ) permit would be needed only if recommended by DFWP.

SUMMARY OF ENVIRONMENTAL EFFECTS

The following table summarizes the environmental consequences of the alternatives. The scientific basis for the environmental effects summarized here is discussed in more detail in Chapter 4 of the Draft EIS.

Table II-3. Comparison of Environmental Effects by Alternative

The following table summarizes some of the environmental effects discussed in Chapter IV.

FOREST CONDITION					
Cover-type Representation	Continued shift toward shade-tolerant species; movement away from historical condition.	Increase shade-intolerant species; movement toward historical condition.		Increase shade-intolerant species; movement toward historical condition.	
Age-Class Distribution and Old-Growth Stands in Project Area	Overall increase to old stands over time; movement away from historical conditions.	Old growth reduced by 460 acres; movement toward historical condition.		Old growth reduced by 42 acres; movement toward historical condition.	
Increase in western larch/ Douglas-fir cover type	No development of replacement stands.	Increase western larch/Douglas-fir cover type by 530 acres; movement toward historical condition	Increase western larch/Douglas-fir cover type by 504 acres; movement toward historical condition	Increase western larch/Douglas-fir cover type by 770 acres; movement toward historical condition	Increase western larch/Douglas-fir cover type by 744 acres; movement toward historical condition
Stand Vigor	Shade-intolerant species crowded out; reduction in vigor (currently 2.42)over time.	Vigor increased to 2.33.	Vigor increased to 2.35.	Vigor increased to 2.38.	Vigor increased to 2.4
Patch size by cover type	Increase in patch size over time.	Decrease in patch size from current condition; maintain patch size in western larch/Douglas-fir.		Decrease in patch size from current condition; increase in patch size in western larch/ Douglas-fir.	
Patch sizes of old growth in the project	Increase in patch size of old growth over time; movement toward historical conditions.	Decrease in average patch size of old growth to 75 acres; movement away from historical conditions.		Maintain average patch size of old growth; movement toward historical conditions	

Table II-3. Comparison of Environmental Effects by Alternative

RESOURCE	A	F	B	D	C	E
Patch shape by cover type	Reduction in complexity of patch shape.					
Patch shape by age class	Decrease in complexity of patch shape; movement toward historical conditions.		Reduction in complexity of patch shape.			
T&E SPECIES (GRIZZLY BEAR)						
Open Roads (% of entire subunit more than 1 mile per square mile)	Open roads would remain the same at 34.6%.					
Open Roads (% DNRC acres more than 1 mile per square mile)	40.8%		A range of increase from existing open-road densities of 32% to a decrease of 22%.			
Total Roads (% entire subunit more than 2 miles per square mile)	30%		No change for all action alternatives.			
Total Roads (% DNRC acres more than 2 miles per square mile)	35.2%		No change for all action alternatives.			
Habitat values influenced by motor activities	Spring - 100% Summer - 100% Autumn - 100%		A range of: Spring - 118-80% Summer - 121-82% Autumn - 123-84%			

Table II-3. Comparison of Environmental Effects by Alternative

RESOURCE	A	F	B	D	C	E
Core Area (DNRC acres)	The Core Area will not change; presently is at 5,894 acres.					
Hiding Cover (DNRC acres)	Unchanged; gradual increase from the present 80% of Coal Creek State Forest.		Reduce cover to 74%.	Reduce cover to 72%.	Reduce cover to 75%.	Reduce cover to 73%.
BIG GAME (ELK AND MULE DEER, WHITE TAIL DEER, MOOSE)						
Forage-dynamics effectiveness	Little short-term change.		Increase in summer forage abundance and availability.			
Snow-intercept effectiveness	Little short-term change.		Reduction in snow intercept.			
Direct human disturbance	Little short-term change.		No detrimental effects.			
BALD EAGLE						
Habitat effectiveness	No substantial changes in any alternative.					
Nesting security	No substantial changes.		Small disturbance during latter portion of nesting.	Potential increase in risk of disturbance.	Small disturbance during latter portion of nesting.	Potential increase in risk of disturbance.
Flight path	No substantial changes.		Small disturbance.	Potential increase.	Small disturbance.	Potential increase.

Table II-3. Comparison of Environmental Effects by Alternative

RESOURCE	A	F	B	D	C	E
WOLF						
Habitat effectiveness	No discernible effects for all alternatives.					
Effects to prey base	Do not anticipate substantive changes in numbers, distribution, or habitat-use patterns of large ungulates, which are the wolf's principle prey.					
Security of denning/ rendezvous sites	No discernible effects for all alternatives.					
AESTHETICS						
Characteristics of general landscape	Change would continue due to natural processes; character of landscape would remain the same.		View of large openings having scattered clumps of trees; visual quality would be affected.		View of small openings that would mimic natural thinnings; visual quality would be affected to a lesser degree than Alternatives B and D.	
WATER QUALITY						
Annual runoff Cyclone Creek watershed	3% increase over natural runoff. (10% allowable increase)		4% increase over natural runoff. (10% allowable increase)	3% increase over natural runoff. (10% allowable increase)	4% increase over natural runoff. (10% allowable increase)	3% increase over natural runoff. (10% allowable increase)
Annual runoff Lower Coal Creek watershed	1% increase over natural runoff (10% allowable increase).		2% increase over natural runoff (10% allowable increase).			

Table II-3. Comparison of Environmental Effects by Alternative

RESOURCE	A	F	B	D	C	E
Annual runoff South Fork of Coal Creek watershed	3% increase over natural runoff (10% allowable increase).					
Harvesting within SMZs	None for any alternative.					
Existing sources of sediment that would be mitigated	Replacement of Dead Horse Bridge.		Replacement of Dead Horse Bridge; 1 mile of existing road rehabilitated; 36.6 miles bought to BMP standards.			
FISHERIES						
Impacts to fisheries habitat	No change to fisheries from current condition.		Low potential risk to fisheries habitat or population; continue to monitor fish habitat.			
AIR QUALITY						
Effects	No change to existing air quality.		Temporary reduction in air quality to a degree that would not exceed the levels defined by EPA, County, State, or local standards.			
SOILS						
Soil erosion potential from road system	Erosion potential may increase on existing road system.		Decrease erosion potential by implementing mitigations.			
Soil impacts: displacement and compaction	No change in existing compaction of the area in old skid trails and landings.		Mitigation would limit impacts to about 5% of the harvested acres; approximately 38 acres would be affected.			
SENSITIVE SPECIES						
Black-backed Woodpeckers	No improvement or degradation to habitat for all alternatives.					

Table II-3. Comparison of Environmental Effects by Alternative

RESOURCE	A	F	B	D	C	E
Common Loons	No improvement or degradation to habitat.		Small disturbance during latter portion of nesting.	No improvement or degradation to habitat.	Small disturbance during latter portion of nesting.	No improvement or degradation to habitat.
Harlequin Ducks	No improvement or degradation to habitat for all alternatives.					
Boreal Owls	No improvement or degradation to habitat.		Detrimental to existing boreal owl habitat.		Possibly some detriment to existing boreal owl habitat.	
Pileated Woodpecker	In the short term, maintain high-quality habitat; in the long term, decrease the habitat quality and quantity.		In the short term, reduce quality of habitat; in the long term, potential abundance of habitat.		Unclear; maintaining large larch trees would, potentially, maintain quality habitat; openings created may be detrimental to nesting habitat.	
Northern bog lemming	No change to all alternatives.					
Fisher	Habitat would improve incrementally.		Some reduction of the overall quality of habitat.			
Lynx	In short term, little change of existing habitat; in long term, gradual reduction to habitat quality.		Denning habitat would be reduced; foraging habitat would be reduced in the short term and increased in the long term; connectivity between foraging and denning elements would be reduced.			

Table II-3. Comparison of Environmental Effects by Alternative

RESOURCE	A	F	B	D	C	E
NATURAL AREA						
Impacts to potential natural areas	No degradation or improvement to areas having the potential qualities to become designated as a natural area.	No degradation or improvement to areas having the potential qualities to become designated as a natural area; may, potentially, resolve some of the natural area questions.	Reduce slightly the potential for a natural area designation.	No degradation or improvement ot areas having the potential qualities to become designated as a natural area.	Reduce slightly the potential for a natural area designation.	No degradation or improvement ot areas having the potential qualities to become designated as a natural area.
ECONOMICS						
Development Cost ($/MBF)	Total cost $200,000 to $350,000 (Funded from FI account)		$32.21	$34.98	$37.30	$39.76
Total timber $ value based on estimated stumpage value, FI cost, and development cost time estimated harvest volume.	($200,000 to $350,000)		$3,949,900	$3,691,670	$2,793,615	$2,702,866
Total timber $ returned to the trust.	$0		$3,098,656	$2,877,338	$2,008,150	$1,944,319
Estimated deferral income	$0	$139,667	$0			

DRAFT EIS (DEIS)

Following scoping, a DEIS is prepared, incorporating public comments relating to the issues that could affect the project. Immediately upon publication, the DEIS is circulated to everyone known to be interested. Comments are accepted for 30 days.

FINAL EIS (FEIS)

DNRC will prepare a FEIS after all public comments to the DEIS are received and evaluated. The FEIS will incorporate new information based on public and internal comments.

NOTIFICATION OF DECISION

Following publication of the FEIS, the Decisionmaker/Stillwater Unit Manager will review the information contained in the DEIS and project file, including public comments. No sooner than 15 days after the publication of the FEIS, the Unit Manager will determine the following:

- Do the alternatives presented in the FEIS meet the purpose of the project?
- Are the proposed mitigations adequate and feasible?
- Which alternative or combination/modification of alternatives should be implemented? Why?

These determinations will be published in a Record of Decision, which will be distributed to all interested parties.

PROPOSED SCHEDULE OF ACTIVITIES

After the Record of Decision is published, and if a timber harvest alternative is selected, a Timber Sale Contract package would be prepared. The package would be sent to the Land Board for approval. If the Land Board approves the timber sale, the sale would be advertised. If the timber is sold, the following schedule would apply:

Stillwater Unit proposes to sell timber from the proposed project in July, 1999, and July, 2000, using 2 separate contracts. Timber harvesting and road construction and improvement work would begin in the late summer of 1999 and be completed by April 15, 2002. Planting and hazard-reduction work would be completed within 2 years following the completion of harvesting. Some activities would be restricted to certain periods of the year to avoid or reduce impacts (see Chapter IV for mitigation information).

CHAPTER I
PURPOSE AND NEEDS

PROPOSED ACTION AND OBJECTIVES

INTRODUCTION AND DESCRIPTION OF THE PROPOSED ACTION

The Department of Natural Resources and Conservation (DNRC), Stillwater Unit proposes to harvest timber in Coal Creek State Forest to generate revenue for the Montana School Trust. The project area is located approximately 2 miles south of Polebridge, Montana, and includes the entirety of 20 sections and portions of 9 sections in T34N, R21W, and T33N, R22W, for a total of 15,060 acres, approximately (see Figure I-1, page 3). If a harvest alternative is selected, 712 to 1,216 acres would be harvested with various silvicultural treatments.

PROJECT NEED

In 1996, DNRC adopted and released the Record of Decision on the State Forest Land Management Plan (SFLMP). The State Board of Land Commissioners approved implementation of the SFLMP on June 17, 1996. The SFLMP outlines DNRC's management philosophy for forested State trust lands and sets out specific Resource Management Standards for 10 resource categories. The SFLMP states:

> *Our premise is that the best way to produce long-term income for the trust is to manage intensively for healthy and biologically diverse forests. Our understanding is that a diverse forest is a stable forest that will produce the most reliable and highest long-term revenue stream... In the foreseeable future, timber management will continue to be our primary source of revenue and our primary tool for achieving biodiversity objectives.*

The lands involved in this proposed project are held by the State of Montana in trust for the support of specific beneficiary institutions, such as public schools, *Enabling Act of February 22, 1889; 1972 Montana Constitution, Article X, Section 11*. The Board of Land Commissioners and DNRC are required by law to administer trust lands to produce the largest measure of reasonable and legitimate return over the long run for these beneficiary institutions, *Section 77-1-202, Montana Codes Annotated* (MCA).

PROJECT OBJECTIVES

The Cyclone/Coal Timber Sale must produce the largest measure of reasonable and legitimate return to the trust in the long run. The sale would also provide a sufficient amount of sawlog volume to contribute to the sustained yield for DNRC as mandated by State Statute 77-5-222, MCA.

The project would move the forest toward the desired future conditions characterized by the proportion and distribution of forest types and structures historically present on the landscape.

RELATIONSHIP TO THE SFLMP

The SFLMP is a programmatic plan that provides field personnel with consistent policy, direction, and guidance for the management of State forested lands. It contains the general philosophies and management standards that will provide the framework for project-level decisions. DNRC made a reasonable attempt to incorporate the philosophy and standards of the SFLMP into this project.

THE ENVIRONMENTAL IMPACT STATEMENT (EIS) PROCESS

EIS DEVELOPMENT

The EIS was prepared in compliance with the Montana Environmental Policy Act (MEPA). MEPA requires State government to include consideration of environmental impacts in its decisionmaking process. It also requires agencies to inform the public and other interested parties of the proposed projects, environmental impacts that might result, and alternative actions that could achieve project objectives.

PUBLIC SCOPING

The initial stage of an EIS is the public scoping process, which is used to inform the public that a State agency is proposing an action and gather comments on the possible impacts of the project. The scope of this EIS was determined by the professional judgement of resource specialists in DNRC and other State and Federal agencies and comments from the public and other interested parties.

DNRC solicited public participation in the Cyclone/Coal timber harvest project on January 10, 1997, by distributing a letter and the initial project proposal to individuals, landowners, organizations, industries, and agencies. As the project continued, interested parties were updated during open houses in April, 1997; a field tour on October 3, 1997; and 4 newsletters at critical points during the development of the project that requested additional input from the public.

The project was advertised in Kalispell's Daily Interlake Newspaper and Columbia Falls' weekly Hungry Horse News. Comments on the project were accepted through December 31, 1997.

The mailing list of parties interested in the project is located in the project file. Public scoping comments are summarized in this chapter; the original comments are located in the project file at the Stillwater Unit Office, Olney.

DRAFT EIS (DEIS)

Following scoping, a DEIS is prepared, incorporating public comments relating to the issues that could affect the project. Immediately upon publication, the DEIS is circulated to everyone known to be interested. Comments are accepted for 30 days.

FINAL EIS (FEIS)

DNRC will prepare a FEIS after all public comments to the DEIS are received and evaluated. The FEIS will incorporate new information based on public and internal comments.

NOTIFICATION OF DECISION

Following publication of the FEIS, the Decisionmaker/Stillwater Unit Manager will review the information contained in the FEIS and project file, including public comments. No sooner than 15 days after the publication of the FEIS, the Unit Manager will determine the following:

- Do the alternatives presented in the FEIS meet the purpose of the project?
- Are the proposed mitigations adequate and feasible?
- Which alternative or combination/modification of alternatives should be implemented? Why?

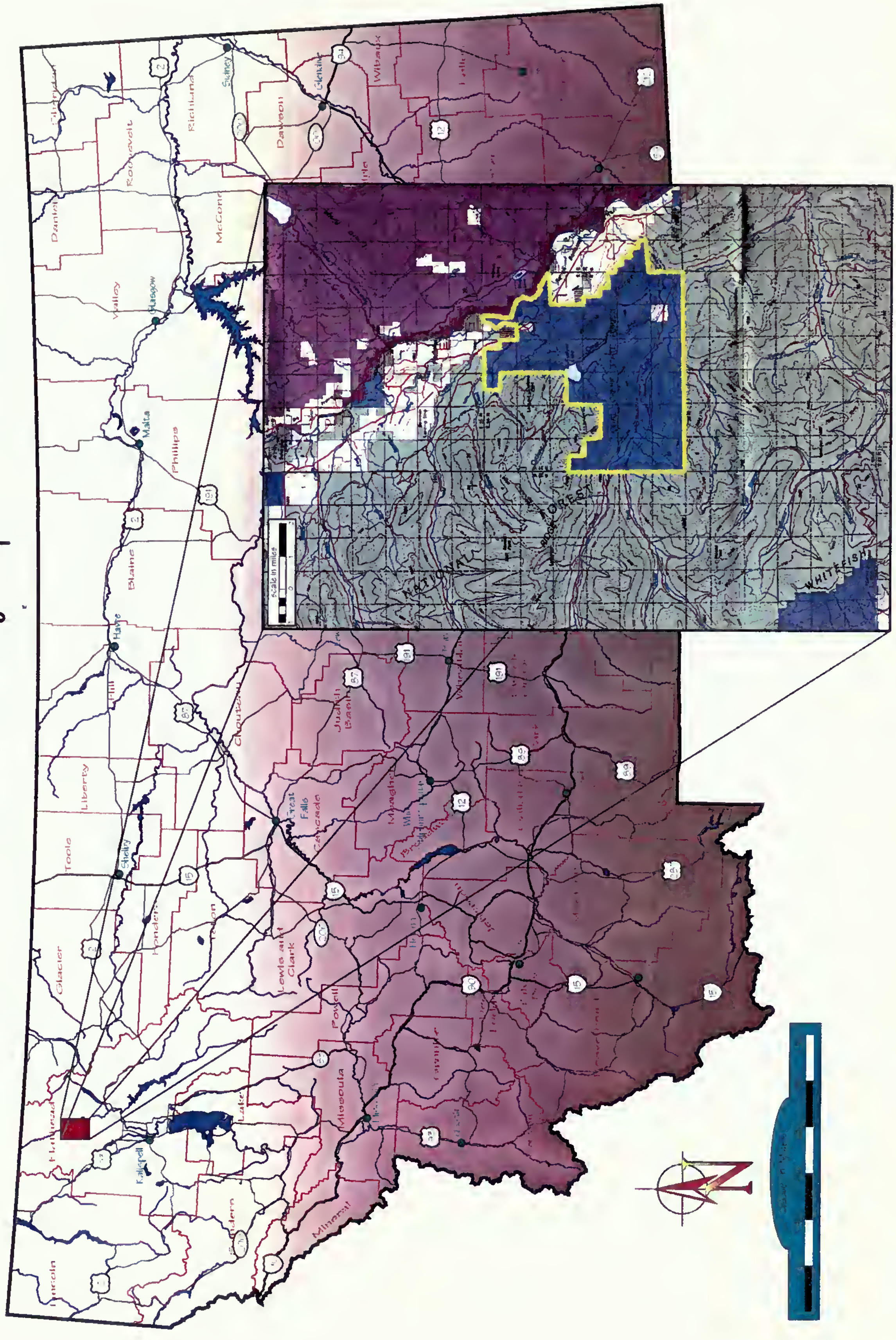
These determinations will be published in a Record of Decision, which will be distributed to all interested parties.

PROPOSED SCHEDULE OF ACTIVITIES

After the Record of Decision is published, and if a timber harvest alternative is selected, a Timber Sale Contract package would be prepared. The package would be sent to the Land Board for approval. If the Land Board approves the timber sale, the sale would be advertised. If the timber is sold, the following schedule would apply:

Stillwater Unit proposes to sell timber from the proposed project in July, 1999, and July, 2000, using 2 separate contracts. Timber harvesting and road construction and improvement work would begin in

Figure I-1
Cyclone/Coal Timber Harvest Project
General Vicinity Map



the late summer of 1999 and be completed by April 15, 2002. Planting and hazard-reduction work would be completed within 2 years following the completion of harvesting. Some activities would be restricted to certain periods of the year to avoid or reduce impacts (see Chapter IV for mitigation information).

OVERVIEW OF THE PROJECT

The Cyclone/Coal proposed timber harvest area is located in Coal Creek State Forest, which is west of Glacier National Park, approximately .75 miles south of Polebridge, and 23 miles north of Columbia Falls (Figure I-2, page 5). The project area is located in the Cyclone and Coal watersheds and the State Coal Cyclone Grizzly Bear Management Subunit.

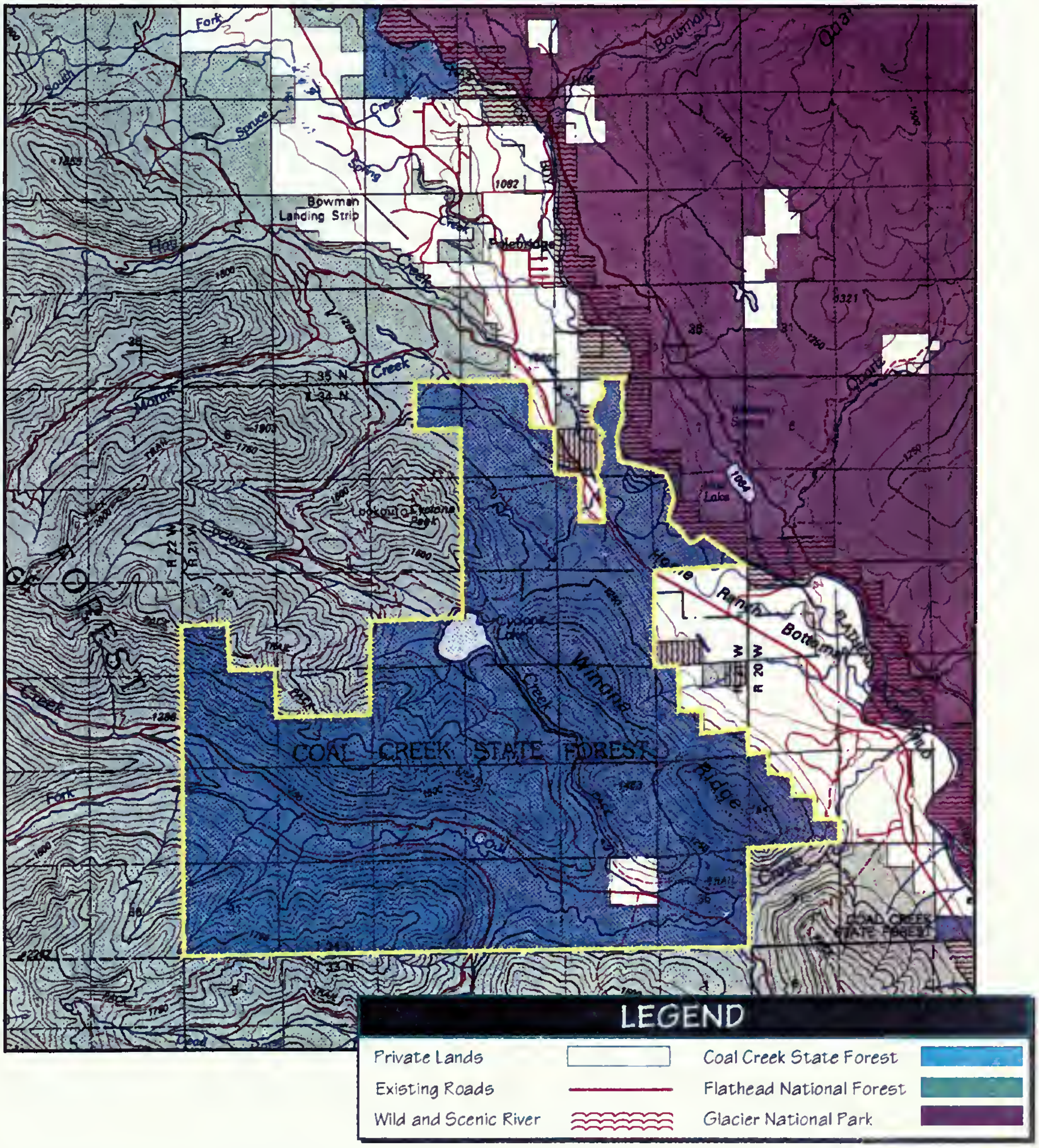
The project covers 15,060 acres and ranges in elevation from 3,710 feet, where Coal Creek leaves the project area, to the 6,766-foot Coal Ridge, located on the western boundary of Coal Creek State Forest. The project area consists of steep canyons, limited access, avalanche chutes, heavily timbered slopes, subalpine terrain, and riparian areas along Coal and Cyclone creeks and the small feeder streams. No major activity has occurred in the project area for the past 11 years.

The project is bordered on the north, south, and west by Flathead National Forest (FNF) lands. The eastern boundary is bordered by Glacier National Park, the North Fork of the Flathead River, and private lands. The project area is colored blue on USFS maps and marked as Coal Creek State Forest.

CRITERIA USED FOR PROJECT DEVELOPMENT

- The total amount of acres in the State Coal Cyclone Grizzly Bear Management Subunit would not be affected, as per DNRC's guidance for the grizzly bear core area.
- Project activities would comply with guidance for all Resource Management Standards specified in the SFLMP.
- DNRC would consider opportunities that would produce long-term revenue, meeting or exceeding that from any timber production that would be foregone.
- Other forest uses, which could coexist in the project area without impacting the goal of producing healthy and biologically diverse forests and would not reduce the potential revenue from timber management, would be accommodated in the project design.
- The project proposal would address the Coal Creek road right-of-way across U.S. Forest Service (USFS) ownership.
- Motorized access would be managed so the needs of the proposed identified harvest can be addressed while still maintaining or improving security for endangered, threatened, and sensitive species.
- Water quality and sensitive fish habitat would be improved by decreasing sediment production and delivery through the following measures:
    - Improve surface drainage on existing roads to meet Best Management Practices (BMPs).
    - Repair and stabilize the existing sources of sediment, including roads, bridges, and culverts, to meet BMPs.
    - Minimize new road construction.
    - Locate activities well away from sensitive bodies of water using protective measures, as described in the SFLMP, and comply with all applicable State and Federal water-quality laws, rules, and guidelines.
    - Set site-specific limits to water-quality parameters to ensure that the proposed activities leave the watersheds well within these limits.

Figure I-2
Cyclone/Coal Timber Harvest Project
Project Area



OTHER ENVIRONMENTAL REVIEWS RELATED TO THE PROJECT

DEAD HORSE RESOURCE MANAGEMENT PROJECT

The Forest Service is analyzing a 390-acre vegetation treatment proposed to be applied on USFS ground located on the southwestern boundary of Coal Creek State Forest. The effects of this proposed vegetation treatment have been analyzed and made a part of this DEIS.

COAL ROADSIDE TIMBER PERMIT

DNRC has proposed to offer the Coal Roadside Timber Permit, located on State land on the south side of Coal Creek, for sale in 1998. A temporary bridge will be used to cross Coal Creek. The effects of this vegetation treatment have been analyzed and made a part of this DEIS.

NOXIOUS WEED MANAGEMENT ON THE LOLO NATIONAL FOREST EIS

DNRC tiered to "NOXIOUS WEED MANAGEMENT ON THE LOLO NATIONAL FOREST EIS (Lolo, 1989)" for analysis of weed-management issues.

INTERIOR COLUMBIA RIVER BASIN ECOSYSTEM MANAGEMENT PLAN (ICBEMP)

At the broad scale, assessments prepared for the 1997 ICRB Draft EIS (ICBEMP 1997) are useful in examining how DNRC's small corner of the larger ecosystem fits into the bigger picture. The ICRB EIS reports on current ecosystem integrity and changes since the arrival of European-Americans. The effects of DNRC's activities at the project level would be negligible at the Basin scale. However, over time, human activities, such as fire suppression, timber harvesting, and building roads and cities, have had cumulative effects on the conditions of the forests across the entire basin.

COOPERATING AGENCIES WITH JURISDICTION/ REQUIRED PERMITS

DEPARTMENT OF FISH, WILDLIFE AND PARKS (DFWP)

DNRC has a contract with DFWP to collect data and monitor fisheries habitat and the status of bull trout and west slope cutthroat trout in the streams of Coal Creek State Forest. A DFWP fisheries biologist commented on fisheries in the Cyclone and Coal drainage; a DFWP wildlife biologist commented on the proposed project's short-term and long-term effects on mule deer habitat.

UNITED STATES FOREST SERVICE (USFS)

In June of 1995 the Northern Region USFS, Bureau of Land Management (BLM), and DNRC entered into an agreement that would enable these parties to acquire reciprocal right-of-way easements across ownerships. This Memorandum of Understanding is based on the Federal Land Policy and Management Act of 1976 (as amended) and the National Forest Roads and Trails Act (FRTA) of 1964 (as amended).

Currently, FNF and DNRC's Northwestern Land Office are in the process of preparing an agreement which would grant the State permanent easements on USFS roads 317, 909, and 1693, which cross through State and Federal land.

Included as part of this agreement, all roads would be reconstructed as necessary to meet the State BMP standards for forest roads (see Watershed section in Chapter III for more details).

PERMITS REQUIRED TO IMPLEMENT THE PROJECT

- A Stream Preservation Act Permit (124 Permit) is required from DFWP for activities that could affect any fisheries stream.

- A short-term exemption from Montana's Surface Water Quality Standards (3A-Authorization) is required whenever

activities introduce sediment above natural levels into live streams. This Department of Environmental Quality (DEQ) permit would be needed only if recommended by DFWP.

CONCERNS RAISED DURING SCOPING

Through the scoping process, concerns were raised by the public and specialists of DNRC and other agencies about the project's potential impacts on the environment. These concerns were used in developing the alternatives (see Chapter II). A summary of the comments that were incorporated into the alternatives is presented below.

VEGETATION

ECOSYSTEM CHARACTERISTICS

Concerns were raised that:

- Timber harvesting would reduce the total area of forest.
- Timber harvesting could alter the ecological characteristics of forested stands in the project area.
- Timber harvesting may reduce the structural and compositional diversities that stands require to function as natural ecosystems.
- Existing stands may be fragmented.
- Edge effects may increase beyond levels acceptable for the maintenance of natural biological diversity.
- Coal Creek State Forest is lacking in early successional forests.
- Seral or intolerant cover types are not represented in proper proportions in the landscape that would historically be expected.
- There is a loss of western white pine on the landscape due to white pine blister rust.
- Fire hazard is extreme due to the amount of dead and down woody debris on the forest floor caused by stagnant lodgpeole pine stands.

OLD GROWTH

Concerns were raised that:

- The character of old-growth stands in the project area might be significantly altered, and the connections of those stands with adjacent old-growth stands could be affected.
- Timber harvesting may ruin the opportunity to use existing old-growth stands as "natural areas" where the ecological uniqueness of old-growth forests could be maintained.
- The amount, distribution, connectivity, and character of the old-growth timber stands in Coal Creek State Forest may be changed by the harvesting within them.
- A lack of development and implementation by DNRC for a long-term, old-growth management strategy exists.
- Old-growth-dependent species may become locally extinct.
- All existing old growth should be maintained due to the lack of a long-range plan for the old-growth stands in Coal Creek State Forest.

TIMBER VALUE

Concerns were raised that:

- Timber sales would no longer support school trusts if the cost of preparation outweighs the returns to the trusts.
- Timber stands should be managed to provide for long-term health and productivity.
- Timber harvesting should be done so the full diversity of structural components, genetic variation, and species mix is maintained in these stands.

WILDLIFE

Cumulative impacts, including past, present, and antcipated future effects, to threatened and endanagered, old-growth-associated, sensitive, cavity-dependent, and big game species was a concern.

GRIZZLY BEAR (THREATENED SPECIES)

Concerns were raised that:

- Road densities would increase.
- Bears could be displaced from seasonal habitats.
- Travel corridors could be disrupted.
- Core or security areas could be reduced

OLD-GROWTH-ASSOCIATED SPECIES

Concerns were raised that old-growth blocks of sufficient size to support these species, with corridors in between, would not be retained.

CAVITY-DEPENDENT WILDLIFE

Concerns were raised that:

- Useable snags of suitable size and species would not be retained.
- Allowance would not be made for the replacement of existing snags over time.
- The populations of cavity-dependent wildlife species would be reduced in the project area.

BIG GAME

Concerns were raised that:

- Timber harvesting could harm elk and white-tailed deer populations.
- Tree removal may reduce the availability of hiding and thermal cover.
- Road construction and improvement may reduce security by increasing the vulnerability of white-tailed deer and elk to hunters.
- Harvesting timber in moist sites could ruin moose and elk habitat.

BALD EAGLE AND COMMON LOON HABITATS

Concerns were raised that:

- Bald eagles and common loons would be displaced from their seasonal habitats and security areas.
- The flight patterns of eagles and common loons would be disturbed.

GRAY WOLF (THREATENED SPECIES)

Concerns were raised that wolves would be displaced from their seasonal habitats and security areas.

FISHERIES

Concerns were raised that bull and westslope cuthroat trouts may be harmed if water quality is adversely affected in the Cyclone and Coal drainages.

WATER QUALITY

Concern was expressed that timber harvesting or road construction may add sediment and increase runoff to the Cyclone and Coal drainages, causing adverse effects to water quality and fisheries habitat.

SOIL

Concern was expressed that timber harvesting might cause soil rutting, compaction, displacement, and loss of productivity.

NOXIOUS WEEDS

Concerns were raised that:

- Weeds have increased rapidly on school trust lands, in particular, where timber harvesting has taken place.
- Weeds would be introduced and spread where timber harvesing is proposed.

ALTERNATIVE MANAGEMENT

Concerns were raised that:

- Management guidelines for resources other than timber, described in the SFLMP, were compromised due to the expected volume needed from State trust lands and, specifically, Coal Creek State Forest.
- Because of this compromise, biodiversity would not be maximized.
- A cooperative agreement lease should be used emphasizing other resource needs that would reimburse the State trusts for any money loss due to the change of management criteria. A 2-year deferral will be analyzed as an alternative for this project.

CULTURAL RESOURCES

Concerns were raised that timber harvesting might cause irreparable harm to any historical or archaeological resources in the project area.

A DNRC archaeologist examined the project area for historical or archaeological resources, but found none. Mitigating measures would be implemented if archaeological resources were found during further examination or during project activities (see Appendix B, Stipulations and Specifications, under Archaeology).

LAND EXCHANGE

Concerns were raised that due to the sensitive nature of Coal Creek State Forest, DNRC management opportunities are limited. Therefore, Coal Creek State Forest should be exchanged for other lands that may be more suitable to the DNRC timber-management program.

CHAPTER II
ALTERNATIVES

INTRODUCTION

Chapter II is organized into two sections. The first section describes the alternatives in detail. The second section is a table that summarizes and compares the environmental consequences associated with each alternative.

DEVELOPMENT OF ALTERNATIVES

An interdisciplinary team (ID team) was formed to work on the project. The role of the ID team was to develop the project and analyze potential impacts on the human and natural environment. The development of alternatives began in January, 1997, when DNRC developed a project proposal describing the proposed action and project time line. The proposal was sent to interested members of the public, adjacent landowners, and other State and Federal agencies for review. Comments were accepted for a 30-day period. Newsletters were sent out during important stages of the project to keep interested parties informed. Input was requested throughout the life of the project.

The ID team reviewed comments received and used them to develop 4 timber-harvesting alternatives, a deferral-type alternative, and a no-action alternative.

DESCRIPTION OF ALTERNATIVES

ACTIONS COMMON TO ALL ALTERNATIVES

The following actions would be implemented under all the alternatives:

- Ensure seasonal closure of road leading to Cyclone Lake during nesting seasons for eagles and loons (winter and spring months).
- Due to structural failure and the potential for sediment entering Coal Creek, replace the Dead Horse Bridge that crosses Coal Creek.
- Bring roads that are under a cooperative agreement with USFS up to BMP standards.
- Treat noxious weeds in accordance with the Flathead County Weed Plan.
- Cooperatively with MDFWP, build, erect, and periodically maintain a floating sign regarding loon nesting and nursery areas.
- Erect and maintain a gate and signs indicating only nonmotorized recreational traffic is allowed on the trail leading toward Cyclone Lake.

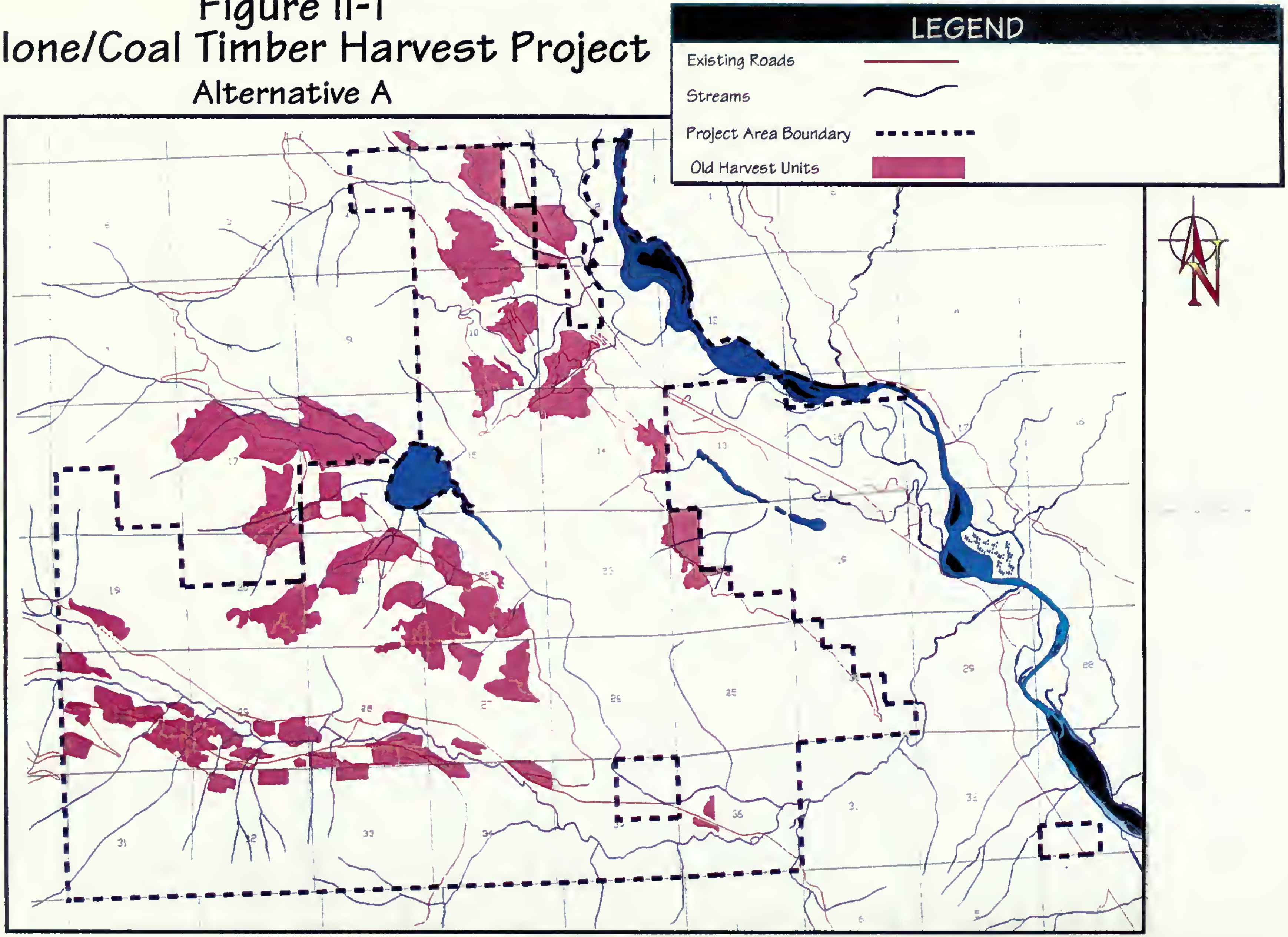
NO-ACTION ALTERNATIVE - ALTERNATIVE A

If Alternative A, the No-Action Alternative, were selected, none of the action alternatives would be implemented. Current management activities, such as fire suppression and road maintenance, would continue. The Dead Horse Bridge would be replaced. The natural progression of cover types toward more shade-tolerant species, such as subalpine fir and spruce, would continue. Following the appropriate level of MEPA review, other land management activities, such as timber harvesting, could be proposed and undertaken in the future. Figure II-1 shows the project area as it would continue to exist under Alternative A. The No-Action Alternative can be used as a baseline for comparing the environmental consequences of the 4 timber-harvesting alternatives and is considered a viable alternative for selection.

TIMBER-HARVESTING ALTERNATIVES - ALTERNATIVES B THROUGH E

The ID Team developed timber-harvesting alternatives based on an analysis of forest stand conditions. Proposed treatments would move the forest toward desired future conditions on the

Figure II-1
Cyclone/Coal Timber Harvest Project
Alternative A



landscape. Three primary concepts were used to differentiate between alternatives:

- The western larch/Douglas-fir and western white pine cover types were determined to be the most underrepresented cover types on Coal Creek State Forest. Each action alternative would increase the proportion of the western larch/Douglas-fir and western white pine cover types, but in a different way.
- The large contiguous blocks of old growth were determined to be important components of the landscape on the Coal Creek State Forest. Each action alternative would affect the old growth blocks in a different way.
- There is potential for establishment of a natural area in the future due to the distinctive resource qualities of portions of the Coal Creek State Forest. The alternatives address these areas in different ways.

In addition to the concepts listed above, the following criteria were used to develop the timber-harvesting alternatives:

- Long-term timber productivity would be maintained or enhanced.
- The natural role of wildfire in this area would be emulated by manipulating the stand structure and species composition using different silvicultural prescriptions.
- Proposed harvest units would be located adjacent to previously harvested units to create groups of young stands, increase the patch size, and reduce fragmentation of mature stands. This is similar to what would occur naturally due to wildfire.
- The location of the harvest units and choice of logging systems would lessen the impacts of road construction and minimize road building.
- The health and vigor of the stands would be improved by reducing the density of the stands, harvesting trees that are dead or being attacked by insects or diseases, and establishing vigorous regeneration with a species that grows best in full sunlight in openings created by harvesting.
- All healthy western white pine would be reserved.
- A connection between existing mature stands would be maintained.
- Security areas for grizzly bears, defined by the State as *core areas*, would be maintained.
- The areas considered for harvest would be forest stands identified in the Coal Creek State Forest stand level inventory and field checked for potential loss of value from insects, diseases, low vigor, and other risk factors.
- Create younger stands of the lodgepole pine cover type.
- A distinctive area south of Coal Creek near the western boundary of Coal Creek State Forest would not be harvested due to diverse ecological characteristics.

STIPULATIONS AND SPECIFICATIONS

Stipulations and specifications, designed to protect natural resources during harvesting and road-building activities, are incorporated into the contract clauses and timber sale administration. A list of stipulations and specifications that would be applied to any alternative in this project are in Appendix A. Mitigations designed to reduce impacts on particular natural resources are also discussed in Chapter IV.

ALTERNATIVES B AND D

Alternative B would harvest approximately 10.6 million board feet (MMBF) from 931 acres in 7 units. Alternative D is the same as Alternative B, except that Unit 1 is excluded. Alternative D would harvest approximately 9.8 MMBF from 699 acres in 6 units (see Figure II-2). Under Alternative B and D approximately .25 mile of new road may be built to access Section 14.

Alternatives B and D increase the proportions of the western larch/Douglas-fir and western white pine cover types by replacing existing mixed-conifer stands with regenerated young western larch/Douglas-fir and western white pine stands. This approach would limit the old growth entered by a concentrated harvest on a limited number of acres. Connectivity between old-growth stands would be maintained by not entering connecting stands.

Alternative D is the same as Alternative B, except that it incorporates the concern that was expressed during alternative development regarding the distinctive qualities (bald eagle nest, common loon nest, and grizzly bear core area) found in the Cyclone Lake drainage. Unit 1 is within the basin and visible from Cyclone Lake and other areas. By not harvesting in Unit 1, the potential to be designated as a "natural area" would be maintained in the future.

Treatment of Unit 1 (Alternative B) - Approximately 35% of Unit 1 would receive the seedtree with reserves treatment; the remaining 65% would have a shelterwood treatment. This unit was selected for this treatment due to the mortality occurring on this southwesterly slope from root rot fungus (*Armillaria*, spp.) The treatment acknowledges the long-term presence of root rots; thus, rather than eradicating root rots, the natural mortality is being salvaged. Over the long term, some gain in genetic resistance may be achieved through the harvest prescription, but root rot will probably always be present at some level. Due to ponderosa pine's greater resistance to root rots, the planting of ponderosa pine is expected to reduce the long-term mortality in this unit.

ALTERNATIVES C AND E

Alternative C would harvest approximately 9.5 MMBF from 1,226 acres in 7 units. Alternative E is the same as Alternative C, except Unit 1 is excluded. Alternative E would harvest approximately 8.9 MMBF from 994 acres in 6 units (see Figure II-4). Under Alternative C and E approximately .25 mile of new road may be built to access Section 14.

Alternatives C and E increase the proportions of the western larch/Douglas-fir and western white pine cover types by removing encroaching midlevel and understory mixed conifer trees in existing western larch/Douglas-fir and western white pine stands. This approach would enter old-growth stands, but retain large old trees, large snags, and concentrations of down woody material. Multiple canopy layers and associated old-growth attributes would redevelop as shade-tolerant species regenerate in the future. Connectivity between old growth stands would be maintained by retaining these old-growth characteristics in the stands.

Alternative E is the same as Alternative C, except that it incorporates the concern expressed during alternative development regarding the distinctive qualities (bald eagle nest, common loon nest, and grizzly bear core area) found in the Cyclone Lake drainage. Unit 1 is within the basin and visible from Cyclone lake and other areas. By not harvesting in Unit 1, the potential for that area to be designated as a "natural area" would be maintained in the future.

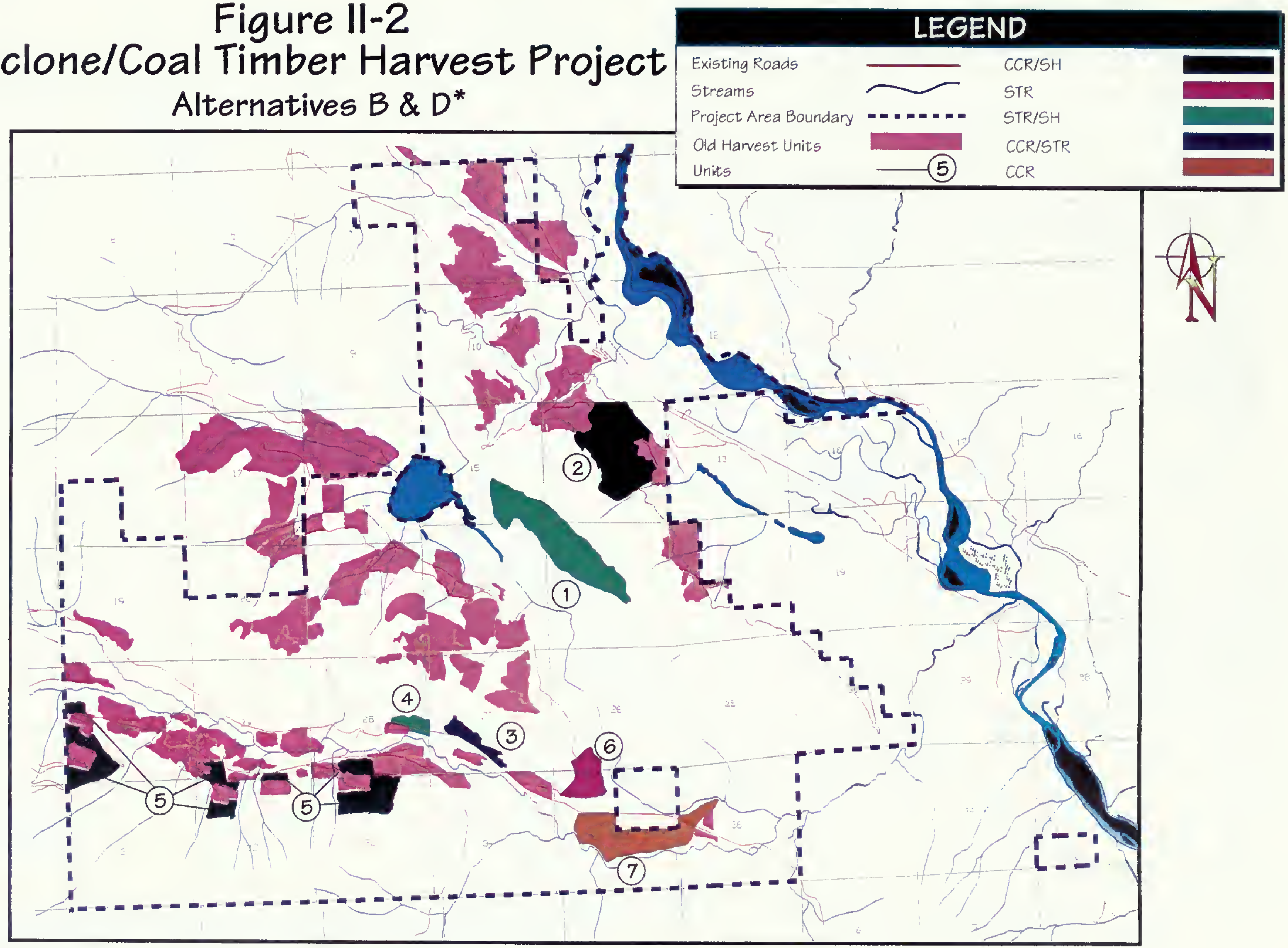
Treatment of Unit 1 (Alternative C) - Approximately 25% of the unit would receive the seedtree with reserves treatment. The remaining 75% would receive a shelterwood treatment. Unit 1 was selected for this treatment because of the mortality occurring due to root rot fungus on this southwesterly slope. This treatment acknowledges the long-term presence of root rots; thus, rather than eradicating root rot, the natural mortality would be salvaged. Over the long term, some gain in genetic resistance may be achieved through our harvest prescription, but root rot will probably always be present at some level. No planting would occur in this unit; instead, the development of naturally resistant Douglas-fir would be relied upon.

Table II-1. Alternatives B and D Unit Treatments

UNIT #	TOTAL ACRES	TREATMENT	HARVEST METHOD	HARVEST VOLUME (MBF)	HAZARD REDUCTION/SITE PREPARATION	REGENERATION
Unit 1 applies to Alternative B only:						
1	232	STR/SH	Helicopter	810	Broadcast-jackpot burn/hand scalp	Plant ponderosa pine
Units 2 through 7 apply to both Alternatives B and D:						
2	218	CCR/SH	Soft track/ tractor	5,232	Broadcast-jackpot burn	Plant western white pine and western larch
3	36	CCR/STR	Tractor	324	Machine pile and scarify	Plant ponderosa pine and western larch
4	21	STR/SH	Tractor	168	Machine pile and scarify	Plant western white pine and western larch
5	200	CCR/SH	Cable, helicopter, and soft track	3,002	Broadcast/jackpot burn and machine pile	Plant western white pine and western larch
6	62	STR	Tractor	310	Machine pile and scarify	Plant western white pine and western larch
7	162	CCR	Tractor	805	Broadcast/jackpot burn	Natural
Alternative B Totals	931			10,651		
Alternative D Totals	699			9,841		

STR - seedtree with reserves CCR - clearcut with reserves
STR/SH - seedtree with reserves with some areas of additional shelterwood retention
CCR/SH - clearcut with reserves with some areas of additional shelterwood retention
CCR/STR - clearcut with reserves with some areas of additional seedtree with reserves

Figure II-2
Cyclone/Coal Timber Harvest Project
Alternatives B & D*



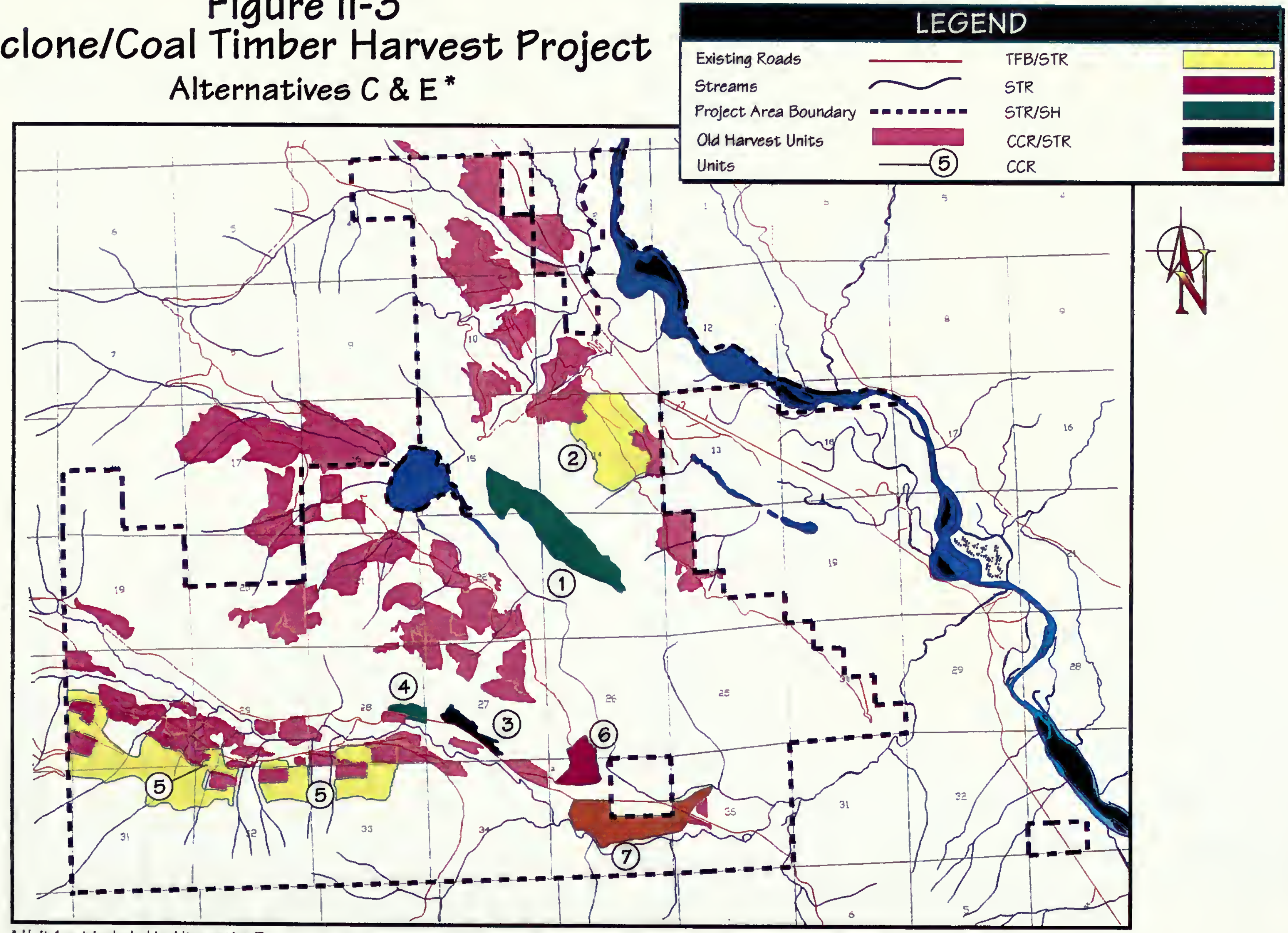
* Unit 1 not included in Alternative D

Table II-2. Alternatives C and E Unit Treatments

UNIT #	TOTAL ACRES	TREATMENT	HARVEST METHOD	HARVEST VOLUME (MBF)	HAZARD REDUCTION/SITE PREPARATION	REGENERATION
Unit 1 applies to Alternative C only:						
1	232	STR/SH	Helicopter	580	Broadcast/ jackpot burn	Natural
Units 2 through 7 apply to both Alternatives C and E:						
2	218	TFB/STR	Soft track/ tractor	2,830	Broadcast/ jackpot burn	Plant western white pine and western larch
3	36	CCR/STR	Tractor	324	Machine pile and scarify	Plant ponderosa pine and western larch
4	21	STR/SH	Tractor	168	Machine pile and scarify	Plant western white pine and western larch
5	495	CCR/SH	Cable, helicopter, and soft track	4,455	Broadcast/jack pot burn and machine pile	Plant western white pine and western larch
6	62	STR	Tractor	310	Machine pile and scarify	Plant western white pine and western larch
7	162	CCR	Tractor	805	Broadcast/jack pot burn	Natural
Alternative C Totals	1,226			9,472		
Alternative E Totals	994			8,892		

STR - seedtree with reserves
CCR - clearcut with reserves
TFB/STR - thinning from below with some openings having seedtrees with reserves
STR/SH - seedtree with reserves with some areas of additional shelterwood retention
CCR/SH - clearcut with reserves with some areas of additional shelterwood retention
CCR/STR - clearcut with reserves with some areas of additional seedtree with reserves

Figure II-3
Cyclone/Coal Timber Harvest Project
Alternatives C & E *



* Unit 1 not included in Alternative E

DESCRIPTION OF SILVICULTURAL TREATMENTS

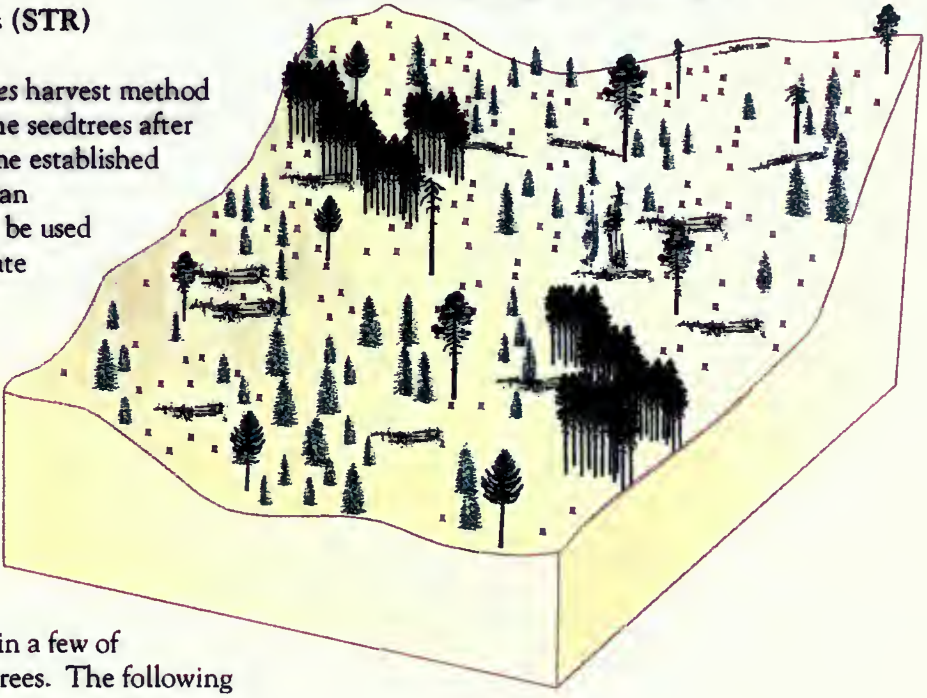
The timber-harvesting alternatives use combinations of 6 silvicultural treatments. The treatments proposed for the Cyclone/Coal project have been designed to imitate the historical effects of natural fires. Natural levels of stand structures will be retained. Forest structures would be maintained in various naturally occurring shapes and sizes. Graphical effects of the proposed silvicultural treatments on harvest units were created. The visualizations are only a qualitative approximation of what would be expected to occur on the ground due to the variations and diversifications of the stands treated in this project. Each visualization portrays the geographical distribution of the treatment effects across a harvest unit. Keep in mind that this is a representation of the remaining geographical distribution of trees and that 1 tree from the visualization does not equate to 1 tree on the ground.

- **Seedtree with reserves (STR)**

  The *seedtree with reserves* harvest method retains some or all of the seedtrees after regeneration has become established to attain goals other than regeneration. It would be used in this project to emulate the effects of a moderately hot fire that would create openings, allowing sunlight to reach the forest floor in 75% to 85% of the area. This treatment would remove most of the midlevel trees and retain a few of the existing overstory trees. The following important stand components would be reserved when available:

  - Approximately 4 to 6 trees with an average diameter of 20 inches per acre; preferred trees would include species that have a high resistance to fire and wind, such as western larch, Douglas-fir, and ponderosa pine. These trees would provide for structural variation and possible snags for future wildlife use. The trees would have crowns intact and represent the healthiest trees available, but not every tree may be seedtree quality. The reserved trees should not be likely to spread disease.
  - Small, scattered clumps of healthy western larch residual in the understory.
  - Approximately 2 live trees with broken boles, which would not be likely to spread disease, per acre.
  - Dead, standing trees that do not qualify as hazards under regulations of the Office of Safety and Health Administration (OSHA).

Seedtree with reserves (STR)

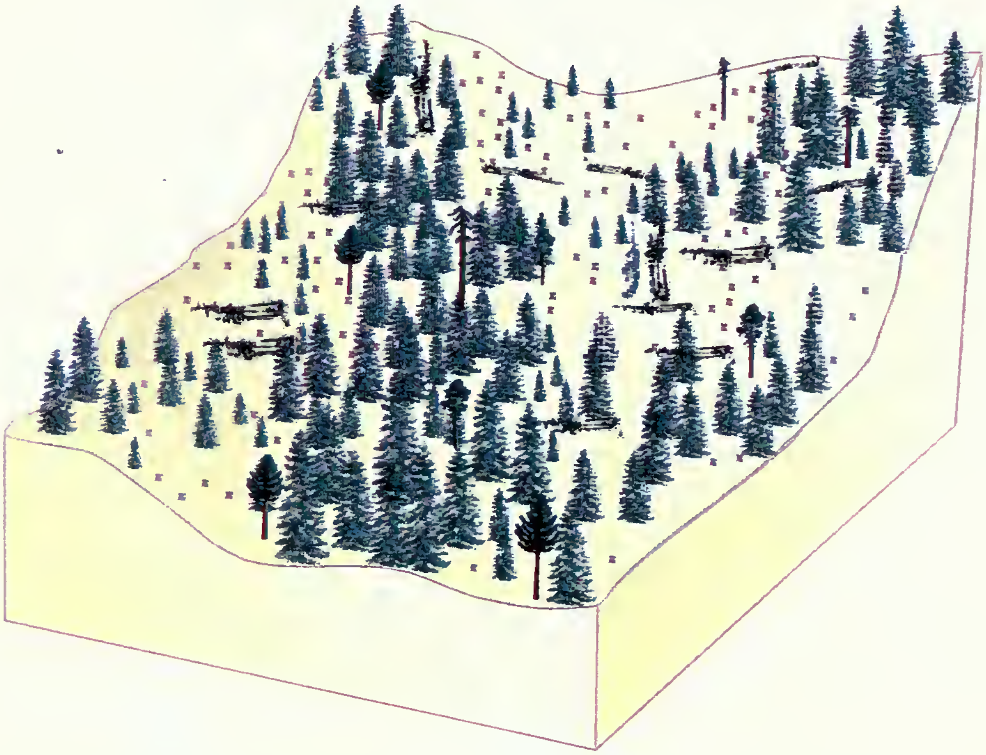


  - Twelve to eighteen tons per acre of large, down woody material; 50% of the down woody material would be 16 feet or longer.

- **Seedtree with reserves, with some areas of additional shelterwood retention (STR/SH)**

A *seedtree with reserves, with some areas of additional shelterwood retention* harvest method emulates the effects of a moderately hot fire in approximately 25% to 35% of the area that would create openings that would allow sunlight to reach the forest floor. Sixty-five to seventy-five percent of the area would reflect the low-intensity-type fire where the overstory and understory would not be affected. The following important stand components would be reserved when available:

Seedtree with reserves, with some areas of additional shelterwood retention (STR/SH)



- In the openings, which reflect a seedtree with reserves harvest, approximately 6 to 8 disease-resistant trees, a minimum of 18 inches dbh, per acre would be retained. Ponderosa pine and Douglas-fir having good form and a healthy appearance would be the preferred reserve tree species. Depending on availability, reserved trees would be in groups or scattered at random. On slopes greater than 50%, some reserve trees might be damaged during the broadcast burning of logging slash.
- Small scattered clumps of healthy understory.
- Approximately 2 live trees with broken boles per acre that would not be likely to spread disease.
- Dead standing trees that do not qualify as hazards under OSHA regulations.
- Twelve to eighteen tons per acre of large, down woody material; 50% of the material would be 16 feet or longer.

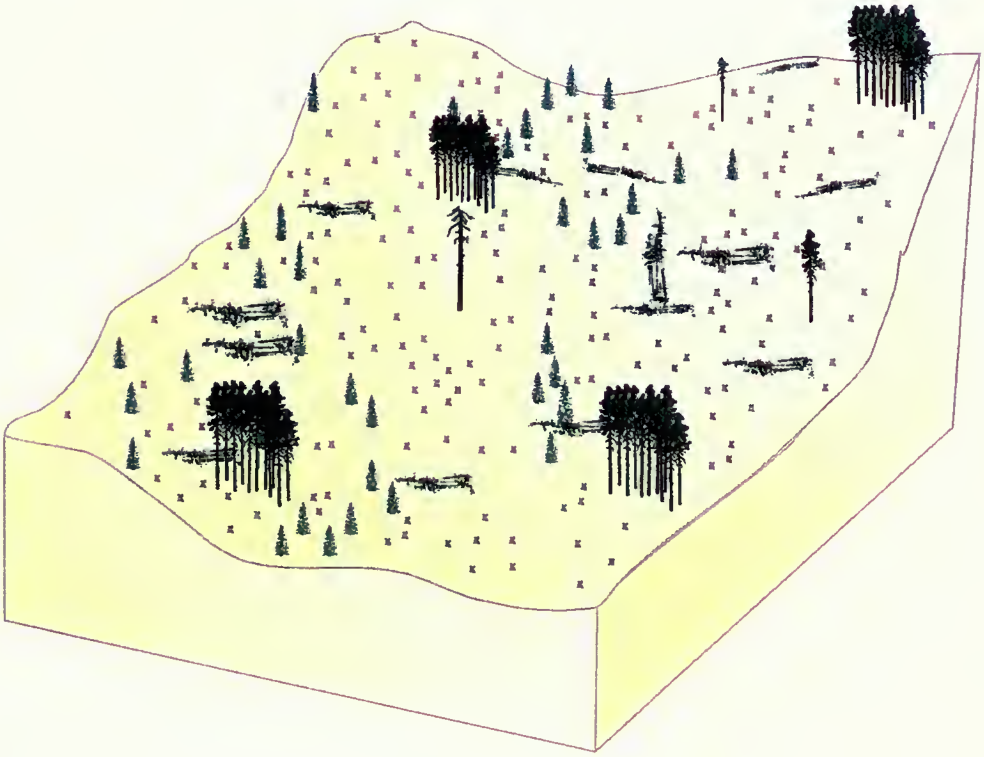
The structure of the forest would be reserved in various naturally occurring shapes and sizes due to the root rot-infected trees being removed from the area.

- **Clearcut with reserves (CCR)**

A *clearcut with reserves* harvest method retains a small amount of trees to attain goals other than regeneration. This method of harvesting would be used to imitate a hot, stand-replacement fire. Small clumps of trees would be maintained throughout the harvested site to provide structural variation. This type of fire would affect the structure and species composition of the overstory and understory vegetation in this stand. The following important stand components would be reserved when available:

- Small, scattered clumps of healthy understory.
- Approximately 2 live trees with broken boles per acre that would not be likely to spread diseases.
- Dead, standing trees that do not qualify as hazards under OSHA regulations.
- Twelve to eighteen tons per acre of large, down woody material; 50% of the material would be 16 feet or longer.

Clearcut with reserves (CCR)

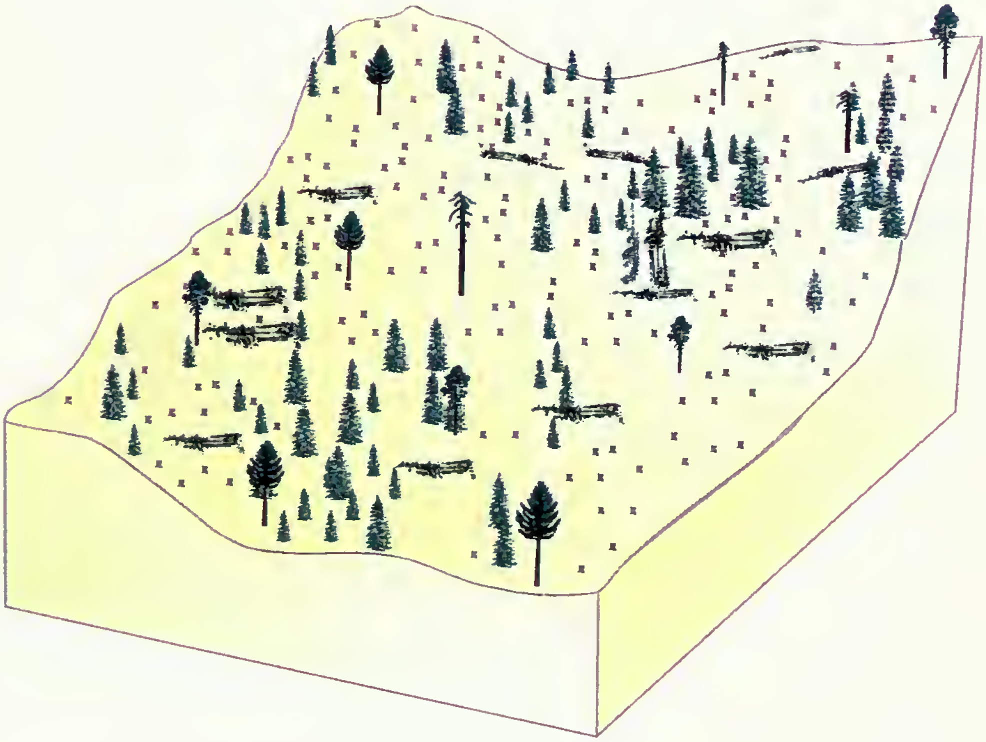


- **Clearcut with reserves, with some areas of additional seedtree with reserves (CCR/STR)**

A *clearcut with reserves, with some areas of additional seedtree with reserves* harvest method retains some or all of the seedtrees after regeneration has become established to attain goals other than regeneration. This method would be used in this project to emulate the effects of a moderately hot fire that would create openings to allow sunlight to reach the forest floor in approximately 85% of the area. This treatment would remove most of the midlevel trees and retain a small amount of overstory trees. The following important stand components would be reserved when available:

  - Approximately 2 live trees with an average diameter of 21 inches and 2 live trees with an average diameter of 18 inches, per acre. Preferred reserve trees include species that have a high resistance to fire and wind, such as western larch, Douglas-fir, and ponderosa pine. The trees reserved would provide for structural variation and possible snags for future wildlife use. The trees would have crowns intact and represent the healthiest trees available, but not all trees may be of seedtree quality. The reserved trees should not be likely to spread disease.
  - Small, scattered clumps of healthy, western larch understory.
  - Approximately 2 live trees with broken boles per acre that would not be likely to spread disease.
  - Dead, standing trees that do not qualify as hazards under OSHA regulations.
  - Twelve to eighteen tons per acre of large, down woody material; 50% of the material would be 16 feet or longer.

Clearcut with reserves, with some areas of additional seedtree with reserves (CCR/STR)

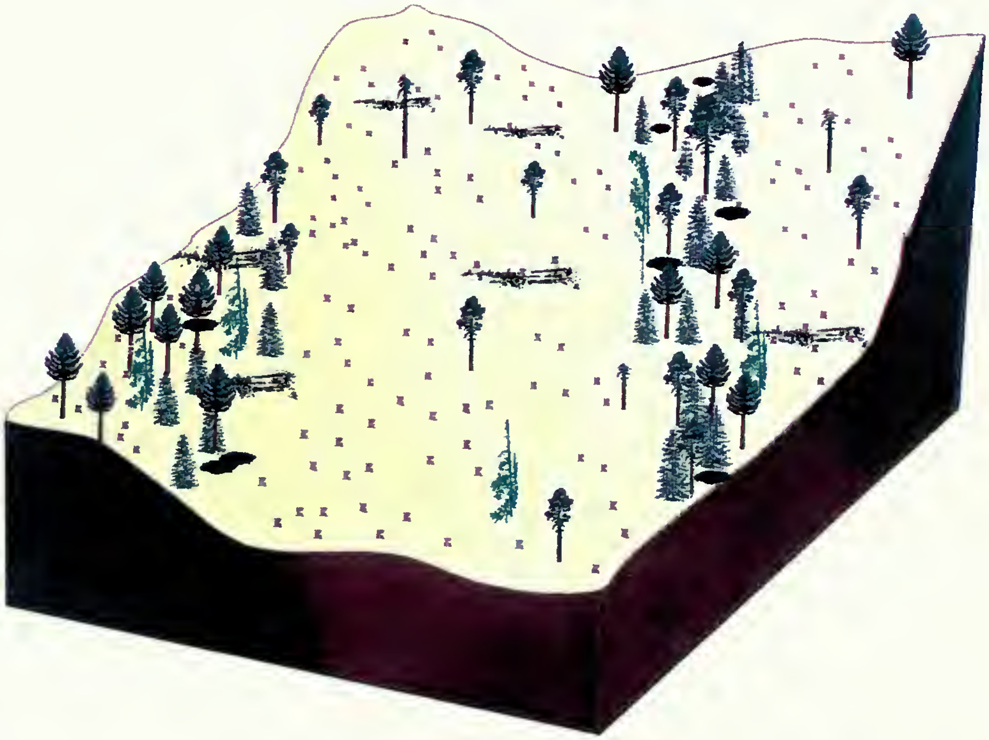


- **Clearcut with reserves, with some areas of additional shelterwood retention (CCR/SH)**

A *clearcut with reserves, with some areas of additional shelterwood retention* harvest method retains some or all of the shelter trees for a longer period of time than normal to attain goals other than regeneration. This method would be used to emulate the effects of a moderately hot fire that would create openings to allow sunlight to reach the forest floor in approximately 85% of the area. On 15% to 20% of the total area, a multistoried structure, referred to here as the shelterwood area, would be maintained. The following important stand components would be reserved when available:

- Approximately 2 trees with an average diameter of 21 inches per acre. Preferred reserve trees would include species that have a high resistance to fire and wind, such as western larch and Douglas-fir. The reserve trees provide for structural variety and possible snags for future wildlife use. These trees would have crowns intact and represent the healthiest trees available, but not every tree may be seedtree quality. The reserved trees should not be likely to spread disease.
- Small, .5- to 5-acre, scattered clumps of healthy western larch, Douglas -fir, western white pine, subalpine fir, and spruce residual in multistoried stands.
- Approximately 4 to 6 live trees with broken boles per acre that would not be likely to spread disease.
- Dead, standing trees that do not qualify as hazards under OSHA regulations.
- Twelve to eighteen tons per acre of large, down woody material; 50% of the material would be 16 feet or longer.

Clearcut with reserves, with some areas of additional shelterwood retention (CCR/SH)

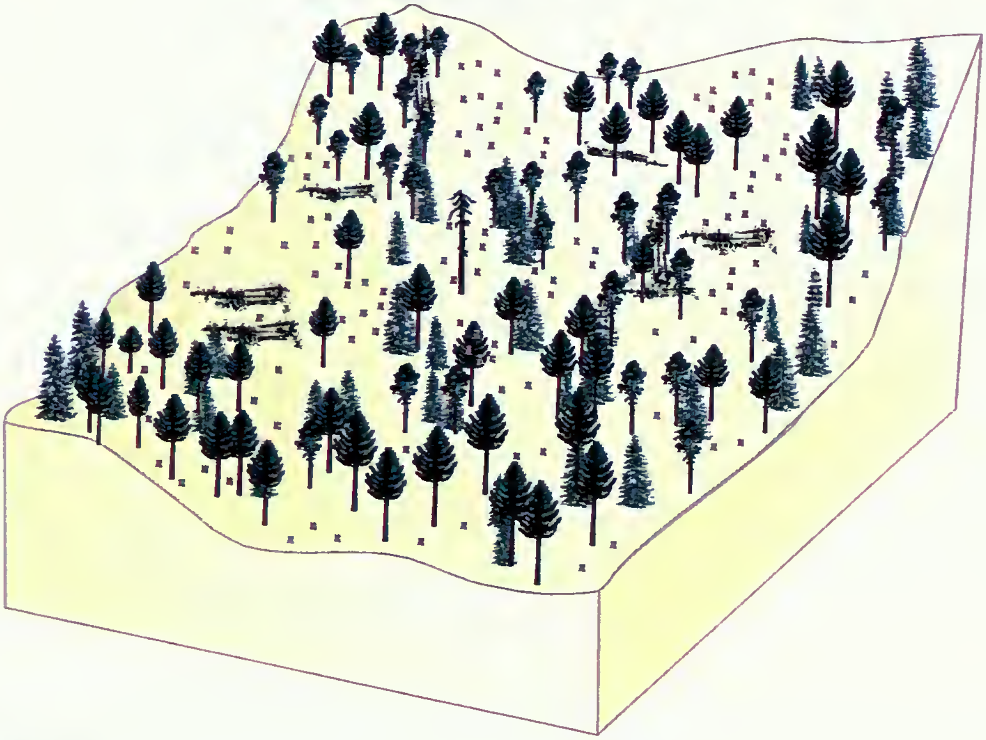


- **Thinning from below, with some openings having seedtrees with reserves (TBF/STR)**

The *thinning from below, with some openings having seedtrees with reserves* harvest method removes trees from the understory to favor those in the overstory. This method would be used to imitate the effects of low- and moderate-intensity fires that burn in periods between the less-frequent, high-intensity fires. Most of the large fire-resistant trees, such as western larch and Douglas-fir, would be retained. This would enable these stands to recover old-growth qualities in a shorter period of time after harvesting. Approximately 90% of the subalpine fir and spruce would be harvested from the understory. Approximately 80% of the western larch and Douglas-fir would be retained in the overstory. Openings up to 2 acres in size would represent the seedtrees with reserves harvest method and would be over 10% to 15% of the area. The following important stand components would be reserved when available:

- Approximately 2 trees with an average diameter of 21 inches per acre would be retained in the openings created by the seedtree with reserves harvest method. Preferred reserve trees would include species that have a high resistance to fire and wind, such as western larch and Douglas-fir. The reserve trees provide for structural variety and possible snags for future wildlife use. These trees would have crowns intact and represent the healthiest trees available, but not every tree may be seedtree quality. The reserved trees should not be likely to spread disease
- Small scattered clumps of healthy western larch residual in the understory.
- Approximately 2 live trees with broken boles per acre that would not be likely to spread disease.
- Dead, standing trees that do not qualify as hazards under OSHA regulations.
- Twelve to eighteen tons per acre of large, down woody material; 50% of the material would be 16 feet or longer.

Thinning from below, with some openings having seedtrees with reserves (TBF/STR)



DEFERRAL ALTERNATIVE - ALTERNATIVE F

Alternative F would defer timber management in the project area for 2 years, during which time a wider area of analysis in the North Fork of the Flathead drainage would be performed by Montana Department of Fish Wildlife & Parks (MDFWP) and The Nature Conservancy (TNC) in conjunction with DNRC to determine and analyze the full range of resource values that exist on Coal Creek State Forest. During the two-year deferral, the trust would be compensated by the interested parties. Following the two-year deferral, several options would exist, including:

- entering into a cooperative private-public partnership to manage Coal Creek State Forest to produce reasonable and legitimate income (including timber management) while giving preference to specific resource values;
- agreeing to defer or manipulate only certain areas of Coal Creek State Forest to meet agreed upon objectives;
- pursuing other forms of cooperative management; or
- returning exclusively to DNRC management.

OBJECTIVES OF DEFERRAL ALTERNATIVE

- Develop a private-public partnership to manage Coal Creek State Forest to produce a reasonable and legitimate income while giving preference, over all other management practices, to special designations, such as:
    - natural areas;
    - critical wildlife habitat;
    - the preservation and restoration of threatened, endangered, and sensitive species; and
    - the maintenance of water and air quality.
- Determine locations and values of DNRC timber stands in relation to the overall North Fork of the Flathead drainage, especially old-growth and wildlife values related to the DFWP Hungry Horse Dam wildlife mitigation goals. This would expand the analysis beyond the boundaries of the Coal Creek State Forest and emphasize resource management values that go beyond the guidance of the SFLMP.
- Replace income ($139,667) of timber harvesting that would not be earned by the school trust while planning is completed. Income would be substituted under the provisions of State Statute 77-5-223, MCA.

HOW TO ACCOMPLISH

A 2-step decision process would be needed to implement Alternative F. The initial decision would be to defer a timber-harvesting alternative in order to pursue the development of this proposed management strategy. If that decision is made, a second decision would be required to adopt or reject whatever proposals are developed during the 2-year planning period.

- Step 1 - This alternative would allow interested parties to purchase the right to jointly develop a management strategy over a 2-year period by deferring the proposed timber harvest. They would pay the expected amount of money to the trust that would be received if another action alternative was selected and the timber sold.

During the deferral period, the Nature Conservancy and DFWP would cooperate with DNRC to determine the resources to be managed, how they would be managed, and the comparison of the values generated from Alternative F as compared to managing strictly under the SFLMP. The Nature Conservancy, possible other interested parties, and/or DFWP would fund an analysis of a wider area to determine the value of the Coal Creek State Forest timber stands and the management strategies to be applied. For example, characteristics, such as old growth, that contribute to the overall natural life cycle of the forest located in the North Fork drainage, but differ from guidelines set by the SFLMP, would need to be designated for management by the State Land Board.

Since a cooperative management strategy may not use typical management practices on State forest land, DNRC would need to determine during the deferral period the methodology, responsibilities, and legal examples for this type of agreement. The agreement would develop a long-term partnership between DNRC and private individuals or organizations. DNRC would determine the amount of money lost to the trust using Alternative F compared to the management strategy found in the SFLMP. Alternative F would reimburse the trust for the difference, as well as fund other opportunities to manage the natural resources not stated in the SFLMP.

- Step 2 - Following the initial deferral period and acquiring the results of the wider analysis area, the second decision would be made. The results listed below, and others not thought of, could be adopted:

  . A long-term cooperative management agreement for the entire Coal Creek State Forest with the Nature Conservancy, DFWP, and, potentially, other entities.

  . Agreements that postpone or manipulate certain areas of Coal Creek State Forest to meet the Nature Conservancy or Hungry Horse Wildlife Mitigation Fund goals.

  . Recommendations for pursuing other forms of cooperative management.

  . Exclusive DNRC management. This may mean:

    * implementing one of the timber-harvesting alternatives for this project;

    * proposing new projects;
    * adopting a different overall strategy based on the results of the analysis;

    * meeting the cooperators' objectives under the SFLMP without additional management agreements and their associated costs;

    * not reaching an agreement; or

    * funding from the cooperators was lacking.

STATUS OF ALTERNATIVE F

Since Alternative F was analyzed, DFWP informed DNRC that funding from their sources would not be available for implementation of this alternative, making DNRC unable to select this alternative. DFWP would still like to work with DNRC to cooperatively develop this alternative management philosophy in the future.

Table II-3. Comparison of Environmental Effects by Alternative

The following table summarizes some of the environmental effects discussed in Chapter IV.

FOREST CONDITION					
Cover-type Representation	Continued shift toward shade-tolerant species; movement away from historical condition.	Increase shade-intolerant species; movement toward historical condition.		Increase shade-intolerant species; movement toward historical condition.	
Age-Class Distribution and Old-Growth Stands in Project Area	Overall increase to old stands over time; movement away from historical conditions.	Old growth reduced by 460 acres; movement toward historical condition.		Old growth reduced by 42 acres; movement toward historical condition.	
Increase in western larch/ Douglas-fir cover type	No development of replacement stands.	Increase western larch/Douglas-fir cover type by 530 acres; movement toward historical condition	Increase western larch/Douglas-fir cover type by 504 acres; movement toward historical condition	Increase western larch/Douglas-fir cover type by 770 acres; movement toward historical condition	Increase western larch/Douglas-fir cover type by 744 acres; movement toward historical condition
Stand Vigor	Shade-intolerant species crowded out; reduction in vigor (currently 2.42)over time.	Vigor increased to 2.33.	Vigor increased to 2.35.	Vigor increased to 2.38.	Vigor increased to 2.4
Patch size by cover type	Increase in patch size over time.	Decrease in patch size from current condition; maintain patch size in western larch/Douglas-fir.		Decrease in patch size from current condition; increase in patch size in western larch/ Douglas-fir.	
Patch sizes of old growth in the project	Increase in patch size of old growth over time; movement toward historical conditions.	Decrease in average patch size of old growth to 75 acres; movement away from historical conditions.		Maintain average patch size of old growth; movement toward historical conditions	

Table II-3. Comparison of Environmental Effects by Alternative

RESOURCE	A	F	B	D	C	E
Patch shape by cover type	Reduction in complexity of patch shape.					
Patch shape by age class	Decrease in complexity of patch shape; movement toward historical conditions.		Reduction in complexity of patch shape.			
T&E SPECIES (GRIZZLY BEAR)						
Open Roads (% of entire subunit more than 1 mile per square mile)	Open roads would remain the same at 34.6%.					
Open Roads (% DNRC acres more than 1 mile per square mile)	40.8%		A range of increase from existing open-road densities of 32% to a decrease of 22%.			
Total Roads (% entire subunit more than 2 miles per square mile)	30%		No change for all action alternatives.			
Total Roads (% DNRC acres more than 2 miles per square mile)	35.2%		No change for all action alternatives.			
Habitat values influenced by motor activities	Spring - 100% Summer - 100% Autumm - 100%		A range of: Spring - 118-80% Summer - 121-82% Autumn - 123-84%			

Table II-3. Comparison of Environmental Effects by Alternative

RESOURCE	A	F	B	D	C	E
Core Area (DNRC acres)	The Core Area will not change; presently is at 5,894 acres.					
Hiding Cover (DNRC acres)	Unchanged; gradual increase from the present 80% of Coal Creek State Forest.		Reduce cover to 74%.	Reduce cover to 72%.	Reduce cover to 75%.	Reduce cover to 73%.
BIG GAME (ELK AND MULE DEER, WHITE TAIL DEER, MOOSE)						
Forage-dynamics effectiveness	Little short-term change.		Increase in summer forage abundance and availability.			
Snow-intercept effectiveness	Little short-term change.		Reduction in snow intercept.			
Direct human disturbance	Little short-term change.		No detrimental effects.			
BALD EAGLE						
Habitat effectiveness	No substantial changes in any alternative.					
Nesting security	No substantial changes.		Small disturbance during latter portion of nesting.	Potential increase in risk of disturbance.	Small disturbance during latter portion of nesting.	Potential increase in risk of disturbance.
Flight path	No substantial changes.		Small disturbance.	Potential increase.	Small disturbance.	Potential increase.

Table II-3. Comparison of Environmental Effects by Alternative

RESOURCE	A	F	B	D	C	E
WOLF						
Habitat effectiveness	No discernible effects for all alternatives.					
Effects to prey base	Do not anticipate substantive changes in numbers, distribution, or habitat-use patterns of large ungulates, which are the wolf's principle prey.					
Security of denning/ rendezvous sites	No discernible effects for all alternatives.					
AESTHETICS						
Characteristics of general landscape	Change would continue due to natural processes; character of landscape would remain the same.		View of large openings having scattered clumps of trees; visual quality would be affected.		View of small openings that would mimic natural thinnings; visual quality would be affected to a lesser degree than Alternatives B and D.	
WATER QUALITY						
Annual runoff Cyclone Creek watershed	3% increase over natural runoff. (10% allowable increase)		4% increase over natural runoff. (10% allowable increase)	3% increase over natural runoff. (10% allowable increase)	4% increase over natural runoff. (10% allowable increase)	3% increase over natural runoff. (10% allowable increase)
Annual runoff Lower Coal Creek watershed	1% increase over natural runoff (10% allowable increase).		2% increase over natural runoff (10% allowable increase).			

Table II-3. Comparison of Environmental Effects by Alternative

RESOURCE	A	F	B	D	C	E
Annual runoff South Fork of Coal Creek watershed	3% increase over natural runoff (10% allowable increase).					
Harvesting within SMZs	None for any alternative.					
Existing sources of sediment that would be mitigated	Replacement of Dead Horse Bridge.		Replacement of Dead Horse Bridge; 1 mile of existing road rehabilitated; 36.6 miles bought to BMP standards.			
FISHERIES						
Impacts to fisheries habitat	No change to fisheries from current condition.		Low potential risk to fisheries habitat or population; continue to monitor fish habitat.			
AIR QUALITY						
Effects	No change to existing air quality.		Temporary reduction in air quality to a degree that would not exceed the levels defined by EPA, County, State, or local standards.			
SOILS						
Soil erosion potential from road system	Erosion potential may increase on existing road system.		Decrease erosion potential by implementing mitigations.			
Soil impacts: displacement and compaction	No change in existing compaction of the area in old skid trails and landings.		Mitigation would limit impacts to about 5% of the harvested acres; approximately 38 acres would be affected.			
SENSITIVE SPECIES						
Black-backed Woodpeckers	No improvement or degradation to habitat for all alternatives.					

Table II-3. Comparison of Environmental Effects by Alternative

RESOURCE	A	F	B	D	C	E
Common Loons	No improvement or degradation to habitat.		Small disturbance during latter portion of nesting.	No improvement or degradation to habitat.	Small disturbance during latter portion of nesting.	No improvement or degradation to habitat.
Harlequin Ducks	No improvement or degradation to habitat for all alternatives.					
Boreal Owls	No improvement or degradation to habitat.		Detrimental to existing boreal owl habitat.		Possibly some detriment to existing boreal owl habitat.	
Pileated Woodpecker	In the short term, maintain high-quality habitat; in the long term, decrease the habitat quality and quantity.		In the short term, reduce quality of habitat; in the long term, potential abundance of habitat.		Unclear; maintaining large larch trees would, potentially, maintain quality habitat; openings created may be detrimental to nesting habitat.	
Northern bog lemming	No change to all alternatives.					
Fisher	Habitat would improve incrementally.		Some reduction of the overall quality of habitat.			
Lynx	In short term, little change of existing habitat; in long term, gradual reduction to habitat quality.		Denning habitat would be reduced; foraging habitat would be reduced in the short term and increased in the long term; connectivity between foraging and denning elements would be reduced.			

Table II-3. Comparison of Environmental Effects by Alternative

RESOURCE	A	F	B	D	C	E
NATURAL AREA						
Impacts to potential natural areas	No degradation or improvement to areas having the potential qualities to become designated as a natural area.	No degradation or improvement to areas having the potential qualities to become designated as a natural area; may, potentially, resolve some of the natural area questions.	Reduce slightly the potential for a natural area designation.	No degradation or improvement ot areas having the potential qualities to become designated as a natural area.	Reduce slightly the potential for a natural area designation.	No degradation or improvement ot areas having the potential qualities to become designated as a natural area.
ECONOMICS						
Development Cost ($/MBF)	Total cost $200,000 to $350,000 (Funded from FI account)		$32.21	$34.98	$37.30	$39.76
Total timber $ value based on estimated stumpage value, FI cost, and development cost time estimated harvest volume.	($200,000 to $350,000)		$3,949,900	$3,691,670	$2,793,615	$2,702,866
Total timber $ returned to the trust.	$0		$3,098,656	$2,877,338	$2,008,150	$1,944,319
Estimated deferral income	$0	$139,667	$0			

CHAPTER III
AFFECTED ENVIRONMENT

ENVIRONMENTAL CHARACTERISTICS, ANALYSIS AREAS, AND ANALYSIS METHODS

This chapter contains information on the environment in the North Fork drainage and Coal Creek State Forest. The size of the analysis areas varies among resources, depending on the requirements of the resource being analyzed and the methods used for the analysis. The cumulative effects of past activities are discussed in this chapter.

PROJECT AREA

The project area comprises approximately 15,361 acres in the Coal and Cyclone watersheds. Topography consists mainly of steep canyons, limited access, avalanche chutes, heavily timbered slopes, subalpine terrain, and riparian areas along Coal and Cyclone creeks and small feeder streams. Elevations range from 3,710 feet, where Coal Creek leaves the project area, to the 6,766-foot Coal Ridge, located on the western boundary of Coal Creek State Forest.

The project area is bordered on the northeast by Moran Creek's steep canyons as the creek leaves the project area. Coal Ridge, running generally east and west, borders the northwest portion of the project area. The eastern boundary is located on the steep southeasterly face of Winona Ridge and, further south, moves to the flat bottomlands of the North Fork of the Flathead River. The southern boundary extends along alpine terrain on an unnamed ridgetop leading into the Dead Horse drainage area from the west and the steep ridges of the north end of Demers Ridge on the east. The western border extends between the west end of the aforementioned unnamed ridge and Coal Ridge. It is in this area that Coal Creek enters the project area, ultimately flowing into the North Fork of the Flathead River.

OVERVIEW OF FOREST CONDITIONS

This section summarizes the descriptions of the affected environment for forest conditions.

CURRENT CONDITIONS

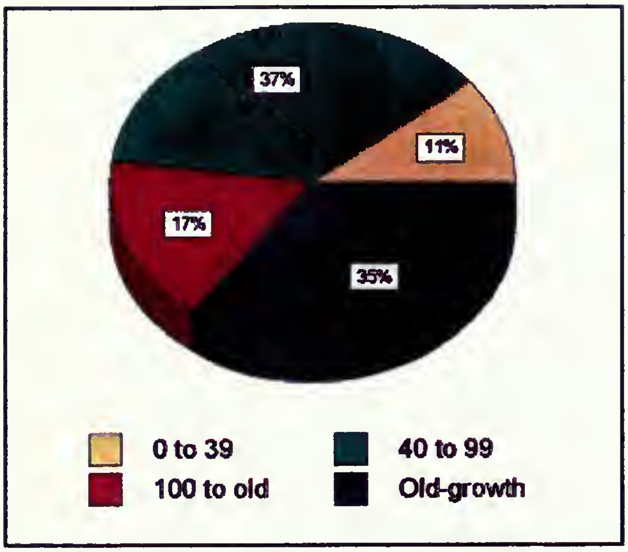
A landscape-level analysis of the Coal Creek State Forest was completed to determine current conditions regarding habitat types, cover-type representation, age-class distribution, patch characteristics, and spatial arrangement.

Coal Creek State Forest is a cool, generally moist, forest, as indicated by the dominance of the cool habitat types. Approximately 60% of the forest is cool and moist, while approximately 22% is cool and moderately dry.

The species composition of the stands reflect this cool condition. Much of the forest has avoided a large-scale disturbance for many years. This has allowed succession to shift cover-type representation from dominance by shade-intolerant species, such as western larch and Douglas-fir, to dominance by shade-tolerant species, such as subalpine fir, spruce, and mixed-conifer stands. The subalpine fir, lodgepole pine, and mixed-conifer cover types each represent about 25% of the forest. The 25% in lodgepole pine represents a much decreased proportion from the 1930s. The western larch/Douglas-fir and Douglas-fir cover types are represented to a lesser degree.

Age-class distributions (Figure III-1) show approximately 5,306 acres, or 35%, of Coal Creek State Forest are in old-growth stands. Reflecting the proportion that has received some harvest in the last 40 years, 11% is under age 40. The 37% in the 40- to 99-year age class reflects the last flurry of major disturbances that occurred in the area, primarily stand-replacement fires in lodgepole pine stands. The remaining 17% is mature forest in the 100- to 150-year age class.

Figure III-1 Current Coal Creek State Forest Age-Class Distribution



The mean cover-type patch size is 123 acres, while patches of equal age class have a mean size of 124 acres. The mixed-conifer cover-type patches are the largest with a mean of 229 acres. The mean old-growth patch size is 332 acres.

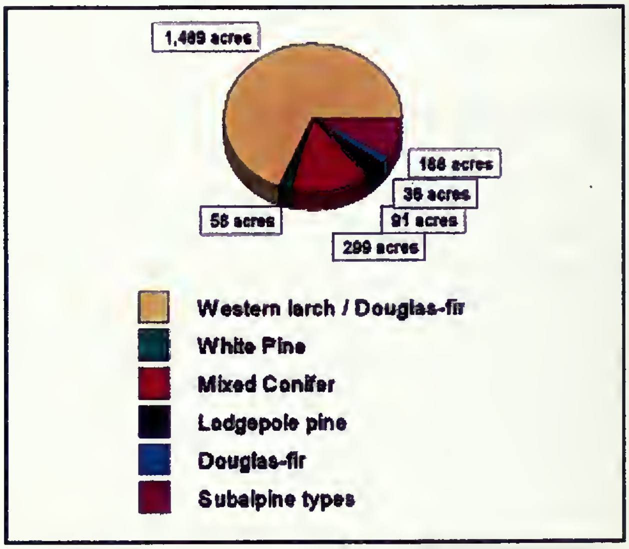
APPROPRIATE CONDITIONS AND DNRC OLD-GROWTH COMMITMENT

DNRC must develop an assessment of forest conditions appropriate to meeting the SFLMP commitments. Among those commitments is retention of 50% of the old growth expected to develop under natural processes on similar sites. Additionally, the SFLMP states that we will manage for appropriate stands on appropriate sites. The combination of old-growth requirements and appropriate stands on appropriate sites gives us what we call 'appropriate conditions'.

A landscape analysis of the stands in Coal Creek State Forest was done using our Stand Level Inventory (SLI) to develop a quantification of appropriate forest conditions by cover-type representation. The information was combined with estimates of broad-scale age-class distributions to quantify our old-growth retention minimums. This 2-stage process to determine appropriate conditions yielded the following minimum acres of old growth stands to retain by cover type: western larch/Douglas-fir, 1,489 acres; western white pine, 56 acres; mixed conifer, 299 acres; lodgepole pine, 91 acres; Douglas-fir, 36 acres; subalpine types, 188 acres; for a total of 2,159 acres of old growth (Figure III-2).

Currently, COAL CREEK STATE FOREST contains 5,306 acres of old-growth stands in the following cover types: western larch/Douglas-fir, 618 acres; western white pine, 443 acres; mixed conifer, 2,277 acres; lodgepole pine, 0 acres; Douglas-fir, 710 acres; and subalpine types, 1,258 acres (Figure III-3). Figure III-18 shows the location of these cover types. Whereas Coal Creek State Forest has more acres of old-growth stands than our defined minimum, they are not distributed appropriately by cover type. For example, the western larch/Douglas-fir cover type is underrepresented in old-growth stands while all other types, except lodgepole pine with 0 acres of old-growth stands, are over the required minimums.

Figure III-2 SFLMP Minimum Old-Growth Acres to Maintain on Coal Creek State Forest



Appropriate cover-type assessments showed that the western larch/Douglas-fir cover type was also underrepresented (6,335 acres versus the current 1,813 acres). The subalpine and mixed-conifer cover types were each overrepresented by more than 2,000 acres when comparing our defined appropriate conditions to currently existing conditions.

Figure III-3 Current Acres of old Growth on the Coal Creek State Forest

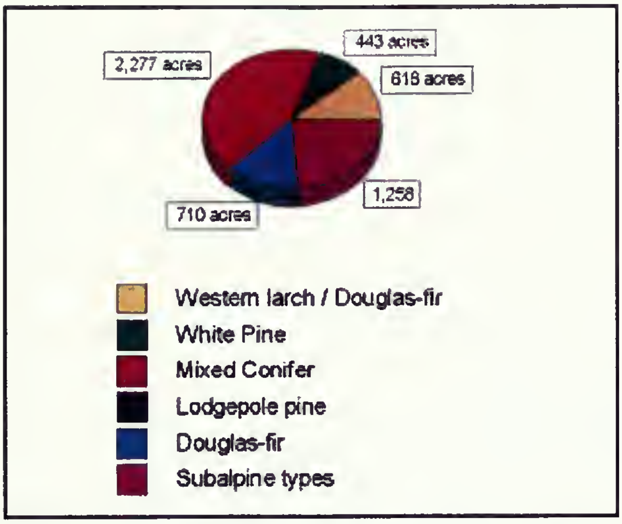
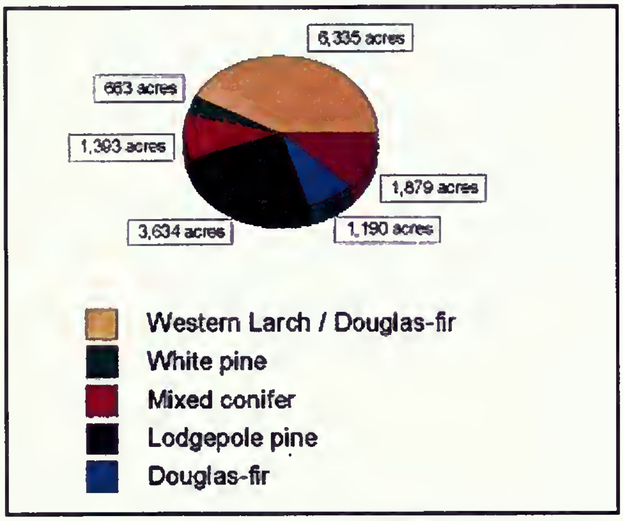


Figure III-4 Appropriate Acres by Cover Type for the Coal Creek State Forest



CURRENT AND APPROPRIATE CONDITIONS

The discrepancies between current and appropriate conditions were analyzed to help focus efforts on moving the forest, as a whole, in the direction of achieving our desired, or appropriate, conditions. Principally, that effort focused on converting stands of mixed conifers into western larch/Douglas-fir cover types. It also meant developing alternatives that changed the cover type of old mixed-conifer stands to old western larch/Douglas-fir stands.

ORGANIZATION OF ANALYSIS

The vegetation analysis is composed of four different sections: 1) Forest Conditions, 2) Historical Conditions, 3) Current Conditions, and 4) Appropriate Conditions. Within each section, background information, analysis methodologies, and environmental characteristics are discussed in detail.

FOREST CONDITIONS

BACKGROUND

Landscape Analysis

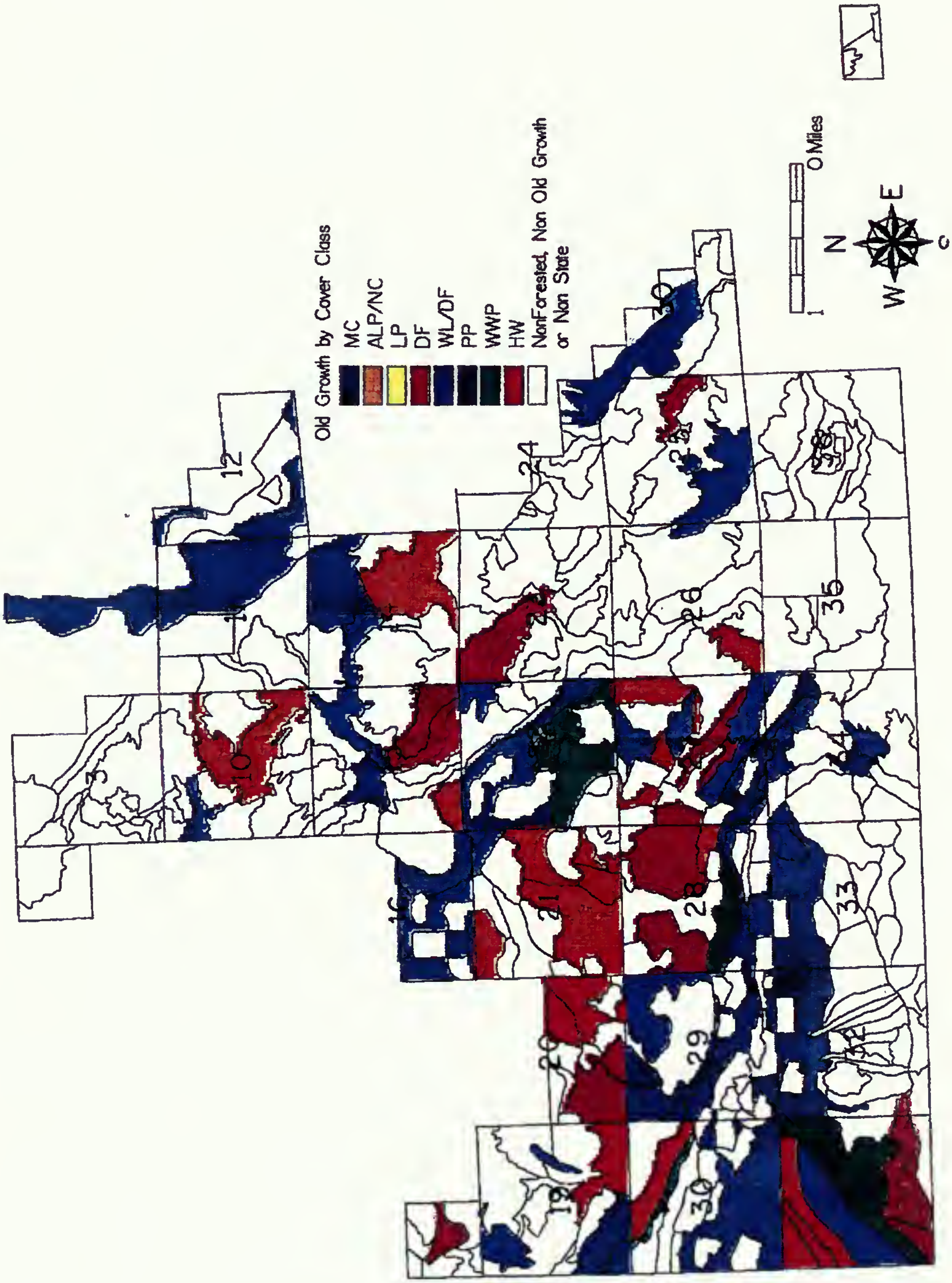
The SFLMP directs DNRC to "take a coarse filter approach to biodiversity by favoring an appropriate mix of stand structures and compositions on state lands" (Montana DNRC Record of Decision, 1996). To implement a coarse-filter approach and meet SFLMP directives, landscape-analysis techniques were used to determine an appropriate mix of stand structures and compositions, including cover-type representation, age-class distribution, structural characteristics, and spatial considerations, such as patch size, shape, and location. Characteristics often associated with old-growth (e.g., degrees of snags, coarse woody debris, decadence, large trees, stocking, and structure) were also analyzed.

Landscape analysis is by its nature a hierarchical process (Turner *et al.* 1993). Different components of the landscape exist and interact at different scales. Relationships among landscape components also exist across varying scales. There is no single best scale where all components of a landscape can be analyzed.

While the SFLMP calls for a landscape analysis to be completed at the project level, some components of a landscape analysis, such as historical forest conditions and various spatial characteristics, are best examined at a broader scale.

At the very broad scale, Federal agencies have recently published a Draft EIS for the Interior Columbia River Basin Project (ICRBEMP 1997). Information from the Draft EIS can be used to describe how small-scale project analyses, such as

Figure III-18 Old Growth by Cover Type on Coal Creek State Forest



that for the Coal Creek State Forest proposed project, fit into the regional picture of ecosystem condition.

In the following analysis, forest characteristics are examined at 5 scales: the stand, Coal Creek State Forest, The Climatic Section, western Montana, and the Interior Columbia River Basin (ICRB). The data are used to determine both historical conditions and project effects on forest characteristics in general, and old-growth forests in particular.

Old-Growth Commitments from SFLMP

The SFLMP states that DNRC would "seek to maintain or restore old growth forest in amounts of at least half the average proportion that would be expected to occur with natural processes on similar sites" (MT DNRC Record of Decision, 1996). Old growth must be retained not only in the amounts committed to, but in appropriate proportions and sites across the landscape. This makes it important to define the proportions of particular forest types that would be expected to develop within particular landscapes, rather than the much easier, but unsustainable, approach of managing simply for what is there now.

To assure that we are meeting our SFLMP commitments, DNRC has adopted a generic definition of old growth. We define old growth as:

Stands that are 150 years and older (140 years for lodgepole pine) that exhibit a range of structural attributes associated with old age.

Although the DNRC has chosen the above definition, we recognize that when defining old-growth minimums for State-forested lands, several complications must be addressed. A restrictive old-growth definition acceptable to all, or even most, resource professionals does not exist. The components important in one type of old growth may not be present or important in another type; thus, a definition of old growth for one forest type may not necessarily be applicable to another forest type. Rather, DNRC approaches the issue from the perspective that the characteristics of old-growth stands that make them functionally different than other stands should be defined and managed for (see **Indicators of Old-Growth Attributes**). Finally, the biggest obstacle related to quantifying the SFLMP's "at least half" minimum is that no quantification of a restrictively defined, naturally occurring amount of old-growth exists, and there is no realistic possibility of one ever being developed.

Although no estimates of historic amounts of old growth are available, there are estimates of historic age-class distributions and accompanying estimates of proportions of old stands. This information is available from a forest inventory conducted in the 1930s across western Montana. Losensky (1997) summarized the 1930s' inventories showing proportional age-class distributions by climatic section:

The proportion of old-growth stands within a given analysis area, compared to the climatic section proportion of old stands from the 1930s' inventory, is DNRC's numeric criterion for assessing compliance with our commitment to retaining a minimum of 50% of old-growth amounts that would be expected to occur with natural processes on similar sites.

DNRC must assess the SFLMP commitment based on historic proportions of old stands, but DNRC is not necessarily equating old stands with old growth, or suggesting that 'old-growth attributes' would be ignored. DNRC will assess the structural attributes associated with old age that characterize the variety of forest conditions that would have naturally occurred on the landscape. Characteristics of stands that are generally associated with the popular term 'old growth' need to be assessed. Old-growth stands that have high levels of 'old growth' characteristics and stands that do not should both be included in DNRC's retention of old growth because DNRC is comparing current old-growth proportions to a historical assessment that included both types of old stands. This degree of old-growthedness approach assures that we will be keeping all the pieces of both the ecosystem and old-growth pies that could and should exist on the land we manage. Various degrees of old growth (i.e., old but not decadent, and old and decadent) are necessary to develop and retain the various characteristics of stands that may be important, but undefined.

Consequently, stands should be assessed as they come up for treatment on a project-by-project basis, keeping some with high 'old-growth' qualities while possibly harvesting others. Additionally, stands that are not technically old may possess many important 'old-growth' components, serving the old-growth function better than some actual old growth, and, thus, should be considered as potential recruitment old growth.

The intent of the SFLMP is to maintain enough old growth to meet the specified old-growth commitment, but to not drop below that amount. The 'at-least-half' amount represents the minimum DNRC has committed to retaining, but does not necessarily represent the maximum desirable for retention.

HISTORICAL FOREST CONDITIONS

This analysis will describe historic conditions of cover-type representation, age-class distributions, habitat-type representations, stand structure, and patch characteristics of size and shape by cover type and age class.

Estimating historical conditions is important in defining the way the forest looked before the widespread influences of the industrial age. The working assumption is that average historical conditions represent a healthy, sustainable, biodiverse forest with all the pieces intact; that is, an appropriate forest condition as committed to in the SFLMP. Historical conditions, tempered by current circumstances, provide an indication of a desirable future condition for the forest. The terms 'appropriate conditions' and 'desirable future conditions' are interchangeable in the context of this EIS. In accordance with the SFLMP Record of Decision (ROD-12, DNRC 1996), this desired future condition is referred to as the appropriate mix of stand structures and compositions on State lands. Appropriate conditions are based on ecological characteristics (habitat type, disturbance regime, unique characteristics) and are characterized by the proportion and distribution of forest types and structures historically present on the landscape.

None of the many ways to characterize the range of historical forest conditions is completely satisfactory. Direct observations over a long period of time would provide a fairly clear picture of a historical range of variability, but these are not available. Actual observation of known historical conditions made over wide areas can provide a similarly clear picture by, in effect, substituting space for time. The 'space for time' concept relies on observations over a broad enough area to encompass the variety of natural disturbances and allow an assessment of trends in vegetation as they are affected by broad-scale climatic factors and disturbance regimes. Such an assessment provides an indication of average conditions similar to what might be obtained from a series of historical observations from different time periods. As the scale is reduced, the impacts of single-disturbance events can unduly influence forest conditions, making the interpretation of average historical conditions difficult and prone to errors. Only by assessing average historical conditions along with current conditions and project effects can the developmental direction of the forest and the actions necessary to move toward appropriate conditions be determined.

DATA SOURCES

At progressively smaller scales than the ICRB (e.g. western Montana and the general climatic section), the best inventory information available to approximate preindustrial-age forest conditions was prepared by Losensky (1997). Losensky summarizes a 1930s' inventory completed for all forest lands in western Montana; his climatic-section data are ideal for the substitution of the 'space for time' concept. The data Losensky used for broader assessments include the original inventory of the Coal Creek State Forest.

The historical inventories were used to provide us with an indication of what appropriate conditions may be, but we are not trying to reimpose any particular set of historical conditions back onto the landscape. This is an important distinction between historical and appropriate conditions.

The 1930s' inventory that Losensky summarized has been digitized for the Coal Creek State Forest and the data carried as a layer in DNRC's Geographic Information System (GIS).

TABLE III-1 PROTOCOL FOR ASSIGNING COVER TYPES IN THE 1930s AND THE CURRENT INVENTORIES

Cover Type*	**Proportional Representation (%) of Species in Each Cover Type**				
	PP	**DF**	**WL**	**WP**	**LP**
Western white pine (WP)				≥ 10	
Ponderosa pine (PP)	≥ 20				
Western larch(WL)/ Douglas-fir		DF + WL ≥70 and WL present			
Douglas-fir (DF)		≥ 60			
Lodgepole pine (LP)					≥ 50
Subalpine types (ST)	Habitat type >630 and stands not yet assigned				
Mixed conifer (MC)	All remaining stands				

*Nonstocked stands assigned to western larch/Douglas-fir cover type; types were assigned in the order listed. Once assigned a stand was not subjected to subsequent assignment criteria.

Cover-Type Representation

The first step in determining appropriate forest conditions is to quantify historical cover-type proportions on the landscape. Losensky (1997) provides historical amounts of cover types (including species composition based on the proportion of stand board-foot volume contributed by each species), corresponding age-class distribution (determined from the same species and size class used for cover type), and the proportion of old stands by cover type. The cover type by age-class data provide an essential component for determining average historical conditions. Table III-1 describes the protocol for assigning cover types for historic and current inventories. Stands are evaluated against the criteria in the table beginning with western white pine and proceeding down the Cover Type column. Once assigned, a stand is not evaluated against other cover-type criteria.

The historical data for proportions of cover types in all of western Montana, Climatic Section 333C, and Coal Creek State Forest are summarized in Table III-2. This climatic section is contained in western Montana and includes the entire Coal Creek State Forest. The climatic section (or the upper Flathead Valley) corresponds to the area between Flathead Lake and the Continental Divide and from the Canadian boundary south to the Clearwater River/Swan River divide.

The data indicate that Climatic Section 333C is cooler and moister than is average for western Montana, with higher proportions of lodgepole pine, mixed conifers, and subalpine types. The lower proportions of ponderosa pine and Douglas-fir also indicate a cooler and moister environment.

Table III-2 shows that historic representation of shade-intolerant tree species (ponderosa pine, western larch, western white pine, lodgepole pine, and Douglas-fir) cover types averaged 67% for western Montana, 56% for the climatic section average, and 65% for Coal Creek State Forest. Lodgepole pine was the predominant forest type according to the 1930s' inventory. The cover-type data suggest that Coal Creek State Forest

TABLE III-2 THE HISTORICAL PROPORTION OF EACH COVER TYPE IN WESTERN MONTANA, CLIMATIC SECTION 333C (UPPER FLATHEAD VALLEY), AND THE COAL CREEK STATE FOREST PROJECT AREA

Cover Type	Proportional Representation (%)*		
	Western Montana	Upper Flathead Valley	Coal Creek State Forest
Ponderosa pine	21	1	0
Douglas-fir	8	<1	4
Western larch/Douglas-fir	26	28	13
Western white pine	3	1	>1
Lodgepole pine	20	27	47
Mixed conifer	3	6	16
Subalpine types	20	36	20
Other types	trace	trace	trace

*Estimated from the 1930s' inventory data. The proportion of area is based on all forested lands; water and nonforest were not included. The Western Montana and Upper Flathead Valley numbers were summarized by Losensky (1997). Coal Creek State Forest numbers are from DNRC analysis of the 1930s' data.

experiences a higher proportion of stand-replacement fires than the entire State or the climatic section. The lodgepole pine data is the primary indicator of this disturbance regime.

AGE-CLASS DISTRIBUTIONS

Age-class distributions delineate another characteristic important for determining average historical or appropriate conditions. When these distributions are combined with information on cover types, a fairly clear picture emerges of the average forest conditions over time. Knowledge about local topographic effects, ecological characteristics of tree species, climatic-vegetational relationships, and disturbance regimes adds clarity to the picture of appropriate conditions.

The 1930s' inventories quantified the ages of forest stands. Losensky examined the data and projected the stands back in time to the early 1900s to arrive at age estimates. These data are useful in setting baseline conditions for determining the extent to which current forest age-class distributions deviate from average historical conditions.

Old stands from the 1930s' data were described as those stands over 170 years of age for ponderosa pine, Douglas-fir, and western larch cover types, over 140 years for lodgepole pine, and over 180 years for the other types. No qualities other than stand age went into the assessments of historical old-stand proportions. Old-growth attributes would exist in a portion of all old stands, but not all old stands would contain old-growth attributes other than age (see **Old Growth Commitments from the SFLMP**).

Tables III-3 through III-6 show the historic age-class structure by cover type for western Montana, climatic section, and Coal Creek State Forest. The data in Tables III-3 and III-4 show the general trend of decreasing proportions in successively older age classes typical of broad-scale assessments. Anomalies do occur within a cover type, such as the western white pine type for the climatic section, where data show only 1% of the acres are in the

TABLE III-3 HISTORICAL AGE-CLASS STRUCTURE BY COVER TYPE FOR ALL OF WESTERN MONTANA (PROPORTIONS (%) ARE BASED ON ACRES WITHIN EACH COVER TYPE)

Cover Type[1]	Nonstocked	1 to 40 years	41 to 100 years	101 years to Old Stands	Old Stands[2]
Ponderosa pine	8	10	11	16	55
Douglas-fir	5	23	33	34	7
Western larch/ Douglas-fir	18	19	13	19	31
Western white pine	23	23	11	22	21
Lodgepole pine	18	39	31	9	3
Mixed conifer	6	11	19	20	43
AVERAGES[3]	15	24	20	18	23

[1] The subalpine-type ages were not summarized in Losenky's report because they were inconsistently reported; some areas had them, others did not.

[2] Stands were considered old if they were over 170 years for ponderosa pine, Douglas-fir, and western larch/Douglas fir; 180 years for western white pine and mixed conifer; and 140 years for lodgepole pine.

[3] The average represents the average age-class structure across all cover types. Nonforested land is not included.

TABLE III-4 HISTORICAL AGE-CLASS (%) STRUCTURE FOR EACH COVER TYPE IN CLIMATIC SECTION 333C (UPPER FLATHEAD VALLEY) (NONFORESTED LAND IS NOT INCLUDED)

Cover Type[1]	Nonstocked	1 to 40 years	41 to 100 years	101 years to Old Stands	Old Stands[2]
Ponderosa pine	2%	11	6	7	74
Douglas-fir	2	24	39	29	6
Western larch/ Douglas-fir	10	13	10	20	47
Western white pine	0	1	28	54	17
Lodgepole pine	21	38	29	7	5
Mixed conifer	2	4	9	42	43
AVERAGES	14	22	13	22	29

[1] The subalpine type was not assigned an age in the 1930s inventory.

[2] Stands were considered old if they were over 170 years for ponderosa pine, Douglas-fir, and western larch/Douglas-fir; 180 years for western white pine and mixed conifer; and 140 years for lodgepole pine.

TABLE III-5 1930s' INVENTORY DATA FOR PROPORTIONAL AGE-CLASS STRUCTURE BY COVER TYPE FOR COAL CREEK STATE FOREST. (THE AVERAGE REPRESENTS THE AVERAGE AGE-CLASS STRUCTURE ACROSS ALL COVER TYPES. THE LAST COLUMN SHOWS THE ACRES OF EACH COVER TYPE AS INVENTORIED IN THE 1930s.)

Cover Type	% of Age Class Per Cover Type					Acres by Cover Type
	No age[1]	0 to 39 Years	40 to 99 Years	100 Years to Old Stands	Old Stands[2]	
Ponderosa pine						0
Douglas-fir				85%	15%	638
Western larch/ Douglas-fir		26		27	47	1,806
Western white pine					100	60
Lodgepole pine	9	72	16		3	7,119
Mixed conifer		<1		16	84	2,420
Subalpine types	20	9		21	51	3,053
TOTALS	10[1]	39	7	13	32	15,098[3]

[1] The no-age category represents land that was not aged in the 1930s' inventory.

[2] Stands were considered old if they were over 160 years for ponderosa pine, Douglas-fir, western larch/Douglas-fir, western white pine, subalpine, and mixed conifer; and 140 years for lodgepole pine.

[3] Additionally, there were 272 acres of nonforest.

nonstocked to 40-year age class, while 28% are in the next older age class. These anomalies are due primarily to the small sample size. Mostly though, given known disturbance regimes, competitive abilities of various species, and ecological requirements, the proportions fall within expected ranges.

The proportions of stands older than 101 years of age, shown in Tables III-3 and III-4, indicate the cooler and moister conditions of the climatic section compared to all of western Montana. Development of this older age-class structure suggests that fire frequency at the climatic-section level is slightly longer than for all of western Montana, and many fires of less than stand-replacement severity occurred, allowing stands to maintain vertical structure and older trees after fires, although at considerably lower stocking or density. Additionally, the general effects of succession are shown in the low proportions of younger age classes of shade-tolerant tree species. The proportion of old-growth stands within a given analysis area compared to the climatic section proportion of old stands from the 1930s' inventory is DNRC's numeric criterion for assessing compliance with our commitment to retaining a minimum of 50% of old-growth amounts that would be expected to occur with natural processes on similar sites.

Historical data compiled for Coal Creek State Forest from the 1930s' inventory are shown in Table III-5. This table shows the irregular age-class distributions typical of smaller scale assessments.

Such distributions reflect an area heavily influenced by individual disturbance events (for the lodgepole type), or lack of disturbances (for the other types).

Comparing Tables III-3 and III-4 to Table III-5 shows that in the 1930s Coal Creek State Forest had slightly more old forest than indicated at the broader scale of the climatic section or western Montana. It also had more young stands than would be expected, reflecting a recent (1900s) series of stand-replacement fires in lodgepole pine forests.

HABITAT-TYPE GROUPS

Habitat-type groups define areas of similar temperature and moisture regimes capable of

TABLE III-6 ACRES OF COVER TYPES ON COAL CREEK STATE FOREST FROM THE 1930S' INVENTORY BY HABITAT-TYPE GROUPS[1]

Cover Type	None	Moderately Warm and Dry	Moderately Cool and Dry	Cool and Moist	Wet	Moderately Cool and Moist	Cool and Moderately Dry	Total
Subalpine	115	46	157	2,008	310	6	411	3,053
Douglas-fir		2	336	242	1		58	638
Lodgepole pine	78	448	340	3,611	105	58	2,479	7,119
Mixed conifer	22	2	140	1,617	413		227	2,421
Nonforest	55			87	129		1	272
Western larch/ Douglas-fir		105	172	1,387	1	39	102	1,806
Western white pine			4	48	8			60
Totals	271	603	1,148	8,999	967	104	3,278	15,370

[1] Habitat type grouping follows Green *et al.* 1993

TABLE III-7 HABITAT-TYPE-GROUP REPRESENTATION ON COAL CREEK STATE FOREST[1]

Habitat Type Group	Acres	Proportion of Area (%)
Moderately warm/dry	603	4
Moderately cool/dry	1,148	8
Cool and moist	8,999	60
Wet	967	7
Moderately cool/moist	104	1
Cool and moderately dry	3,278	22[2]

[1] Habitat-type grouping follows Green *et al.* 1993

[2] Column totals over 100% due to rounding.

supporting particular vegetative associations. Representation of habitat-type groups for the entire Coal Creek State Forest is shown in Table III-6.

Coal Creek State Forest is a cool, generally moist forest, as indicated by the dominance of cool habitat types. The majority of the forest is cool and moist, 60%, while approximately 22% is cool and moderately dry, as shown in Table III-7.

STRUCTURAL CHARACTERISTICS

In the 1930s' inventory summaries, structural characteristics were not defined beyond the same classes used to describe age-class distributions. The structural categories defined for the various age classes were as follows: ages 1 to 40 - seedling to sapling; 41 to 100 - poles; 101 to old stands - mature; and 170 or 180 and over - old stands. These categories may or may not be meaningful due to the strict adherence to stand age used for their assignment.

TABLE III-8 PATCH SIZE AND SHAPE INDEX BY COVER TYPE FROM THE 1930S' INVENTORY ON COAL CREEK STATE FOREST (Patch size is expressed in acres for patches of Equivalent cover type. Patch shape was derived With the patch shape index Of McGarigal and Marks (1994)*.)

Cover Type	n**	Mean Patch Size (acres)	Standard Deviation Patch Size (acres)	Mean Patch Shape	Standard Deviation Patch Shape
Subalpine	6	254	406	1.646	0.411
Douglas-fir	2	319	312	1.645	0.392
Lodgepole pine	7	1017	2313	1.761	0.980
Mixed conifer	13	186	340	1.522	0.306
Nonforest	8	34	75	1.570	0.517
Western larch/Douglas-fir	8	226	143	1.532	0.311
Western white pine	1	60	N/A	1.165	N/A
Total	45	301	895	1.591	0.489

*The patch shape index of McGarigal and Marks (1994) calculates patch shape complexity. The calculation uses the perimeter and area of each patch and corrects for the effects of patch size. A perfectly square patch takes a value of 1. Circular patches have a complexity value less than 1. More irregular shapes take numbers higher than 1.
**Number of patches

TABLE III-9 PATCH SIZE AND SHAPE CHARACTERISTICS BY AGE CLASS FROM THE 1930s' INVENTORY

Age Class	n**	Mean Patch Size	Standard Deviation Patch Size	Mean Patch Shape	Standard Deviation Patch Shape
Blank	6	102	73	1.184	0.226
0-40	5	1180	2172	1.724	1.024
41-100	7	162	259	1.670	0.622
101 - 150	7	291	461	1.629	0.483
150+	6	801	1189	1.184	0.478
None	11	136	267	1.590	0.486
Total	42	380	912	1.578	0.560

*The patch shape index of McGarigal and Marks (1994) calculates patch-shape complexity. The calculation uses the perimeter and area of each patch and corrects for the effects of patch size. A perfectly square patch takes a value of 1. Circular patches have a complexity value less than 1. More irregular shapes take numbers higher than 1.
**Number of patches

PATCH CHARACTERISTICS

Coal Creek State Forest is the only scale analyzed for which historic quantification of patch size and shape information is available. The 1930s' patch size and patch shape indices by cover type are shown in Table III-8.

Historic patch sizes and shapes for different age classes are shown in Table III-9. Note the large patch sizes of the 0 to 40 year age class and the old stand class. The 0 to 40 year age class reflects the then recent stand-replacement fires that burned in the lodgepole pine types. Overall, age-class patch sizes do not differ greatly from cover-type patch sizes. Patch shape information is useful in comparing patches within the same landscape over time. However, due to differences in sampling procedures, direct comparisons with current data are not as informative as they would be if sampling procedures had been identical.

Young, even-aged lodgepole pine stands have the largest patch size and the highest patch-shape complexity. The least complex patches are the old-stand patches.

FOREST FIRE HISTORY IN THE NORTH FORK VALLEY

As in most forests in western Montana, fire has been a major influence on the characteristics of forested landscapes in the North Fork Valley. The site, aspect, species composition, stand structure, and climatic influences help to determine the intensity, size, and frequency a fire would burn. Barrett, Arno, and Key (1990) discuss fire frequencies in the North Fork in their paper titled, Fire regimes of western larch - lodgepole pine forest in Glacier National Park, Montana:

> *In the North Fork study area most age-class samples were from lodgepole pine, and longest fire-scar sequences (three to seven per tree) dated back to the early 1600s on larch and ponderosa pine. We were able to calculate master fire chronologies for eight relatively dry sites where Douglas-fir or hybrid spruce is the potential climax tree, and 12 relatively moist sites where subalpine fir is the potential climax species . Between about 1650 and 1935 both types of sites had roughly similar fire frequencies (grand means of 36 versus 46 years, respectively). Dry-site*

> *mean fire intervals were shortened somewhat by the recurrence of small nonlethal surface fires near ponderosa pine - grassland meadows; these stands experienced as many as seven nonlethal fires (mean interval of 141 years). Moist stands usually had evidence of only one or two nonlethal surface fires occurring between even less frequent stand-replacing fires (mean interval of 186 years).*

The mid-1930s, generally, is when effective fire suppression occurred in the North Fork. Barrett, Arno, and Key (1990) comment that:

> *Wildfires between 1910 and 1936 burned about 39% of the 160,000 ha constituting the three study areas. In fact, 1910 produced the most extensive wildfires recorded in the northern Rocky Mountains (Cohen and Miller 1978), as well as in GNP (30,850 ha). The GNP Fire Atlas indicated that lightning has ignited most fires in this century, but humans also caused several important fires, such as in 1929 (13,000 ha). Three apparently large fires occurred in the North Fork valley between about 1655 and 1683.*

More recent fires in the North Fork have been influenced by insect and disease problems. Between 1972 and 1982, a mountain pine beetle epidemic occurred in the North Fork valley, killing most of the trees in the lodgepole pine stands, producing heavy fuel loads. In 1988, a wind-driven lightning fire, referred to as the Red Bench Fire, occurred in these heavily fueled stands. This fire killed many western larch and ponderosa pine that were more than 350 years old and had survived past fires.

Suppression effects on fire in the North Fork since the mid-1930s have had little impact on the wetter sites due to the fire frequency of 150 to 180 years on these sites. The potential for unnatural forest mosaic change has occurred on drier sites due to man's suppression efforts. Barrett, Arno, and Key (1990) punctuate this in their discussions:

> *The GNP Fire Atlas revealed that 95 ignitions were promptly suppressed in the North Fork study area between 1930 and 1987, some during critical fire weather in the mid-1930s, 1940, and 1967. Eliminating just a few potentially large fires would allow the forest mosaic to advance to later successional stages over a broad area, rather than a mixed pattern of young to old stands.*

FOREST FIRE HISTORY IN COAL CREEK STATE FOREST

The most recent fire history in Coal Creek State Forest, 1936, is found on the east face of Winona Ridge and the north face of the unnamed ridge south of Coal Creek, where a 62-year-old stand of lodgepole pine is located. The 1910 fires are indicated by the lodgepole pine stands found in Cyclone Park and moving up Cyclone and Coal creek drainages. Most of these lodgepole pine stands have western larch and Douglas-fir trees that are 180 years and older scattered throughout.

Older burns are located on the south side of Coal Creek and on the east face of Winona Ridge. These burns are indicated by the western larch, 350 years and older, scattered throughout the 180-year-and-older overstory western larch and Douglas-fir. The presence of these old relics indicate that stand-replacement fires occurred and helped create the stands found here today.

Inventory data and aerial photography verify that stand-replacement fires were dominant in the analysis area and elsewhere along the North Fork drainage. A mixed-severity fire regime was relatively common in the main valley bottom and localized areas within the Coal and Cyclone creek drainages.

SUMMARY OF HISTORIC FOREST CONDITIONS

Historically, the forests of Coal Creek State Forest were often of stand-replacement disturbance-regimes origin. However, mixed-severity fires at shorter return intervals also played a part. The cool nature of the forest allowed succession to occur from shade-intolerant cover types to shade tolerants. Hot fires then burned through, creating conditions conducive to the development of even-aged forests. The dominance of lodgepole pine as a cover type supports this scenario.

Age-class distributions suggest the forest in the 1930s had old stands in, roughly, their historic average amounts. Several large patches of old stands and several patches resulting from burns in the early 1900s dominated approximately two-thirds of the forest.

CURRENT FOREST CONDITIONS

Current forest conditions are described for:

- cover-type representation;
- age-class distributions;
- cover types by habitat types;
- stand structure of all age classes;
- patch size and shape by cover type and age class;
- stand vigor of all age classes;
- insect and disease conditions;
- the relationship to our SFLMP stated committments including:
  - minimum proportions of old growth to retain,
  - minimum acres by cover type; and
  - current levels of old-growth attributes including:
    - number of large diamater live trees,
    - numbers of snags,
    - amount of down coarse woody debris,
    - degree of:
      - decadence,
      - old growth stand structure,
      - stand vigor, and
      - stocking expressed as board feet per acre.

Not all data used to describe historical conditions are available for current conditions, and not all data on current conditions has corresponding data to determine historic conditions. The data presented in this section represents what is available rather than a selected set. Where possible, relationships between historical and current conditions are described using the most appropriate data sets for comparison. The information is presented in order, from the largest to the smallest scale.

The broad-scale trends of decreased proportions of old growth, decreased shade-intolerant tree representation, and corresponding increased shade-tolerant tree cover evident from the ICRB are also demonstrated at the Coal Creek State Forest level.

DATA SOURCES

DNRC assessed current conditions with a SLI that covers the entire State ownership in Coal Creek State Forest. Sources of historical data are described on page III-8, Data Sources. See Table III-1 for methodology used to assign cover types for current inventories.

PAST MANAGEMENT ACTIVITIES

Timber harvesting in the Coal Creek State Forest project area has occurred periodically since the late 1950s. Some harvesting in the early 1960s was in response to a spruce beetle outbreak. These old harvest units are located in the alpine terrain, as well as the low bottoms of the Coal and Cyclone creek drainages. Other harvesting occurred in the early 1980s due to a mountain pine beetle outbreak. These harvest units are located on the east face of Winona Ridge, in Cyclone Park, and on and near the Moran creek drainage. The most recent (1986) harvest units are located on the south side of Coal Creek, adjacent to some of the aformentioned spruce-beetle harvest units of the 1960s.

COVER-TYPE REPRESENTATION

The current age-class structure by cover type for Coal Creek State Forest is shown in Table III-10. Currently, 35% of all stands are 'old' (see Fig. III-1). In the 1930s' inventory, 32% of Coal Creek State Forest existed as old growth. Thus, old-growth representation has slightly increased. Also, since the 1930s, there has been a large shift in cover-type representation to the shade-tolerant climax species, primarily from lodgepole pine. The lodgepole pine type has decreased 53%, while the mixed conifer increased 52%, and the subalpine fir types increased 28%. The trend is similar across the entire ICRB where shade-intolerant species in moist forests have decreased by 86%, while shade-tolerants have doubled compared to historical amounts (ICRBEMP, 1997), but is less extreme within Coal Creek State Forest.

TABLE III-10 - CURRENT COAL CREEK STATE FOREST AGE-CLASS DISTRIBUTION BY COVER TYPE

Cover Type	Age-Class Distribution by %				Acres by Cover Type
	0-39	40-99	100-149	150+	
Douglas-fir	0	19	24	57	1,253
Western larch/Douglas-fir	10	24	33	34	1,813
Western white pine	1	21	2	76	581
Lodgepole pine	13	85	2		3,801
Mixed conifer	16	11	11	58	3,671
Subalpine	9	30	28	32	3,899
Totals	11	37	17	35	15,094

AGE-CLASS DISTRIBUTIONS

Age-class distribution has not changed appreciably other than through aging of existing stands. The effects of previous harvesting is shown in the 0-to-39-year age class. The large proportion of stands in that class from the 1930s has aged into the 40-to-99-year class. See Fig. III-3 for current acres of old growth on the Coal Creek State Forest. Overall, old-growth has decreased by 2%.

The current inventory defines an old-growth stand as any stand over 150 years of age, except for lodgepole pine, which is over 140 years of age. Losensky (using the 1930s' inventory) used break points of 170 or 180 years, rather than the current breakpoint of 150 years. This apparent discrepancy results from the use of different methods to estimate age. The 1930s' inventory used trees over 12- or 14-inches dbh to assign age in sawtimber stands, depending on species. The focus on high-value large trees, such as larch, white pine, ponderosa pine, and Douglas-fir, causes the historical inventory to produce older age estimates of stand age compared to current procedures.

In comparison, the existing DNRC SLI produces younger age estimates of stand age by assigning the average age of all trees larger than 9 inches. The 150-year age limit is conservative when compared to the 1930s' estimates of 170 and 180 years. In the current inventory, many stands as young as 120 years probably would have been assigned an age of 170 or older in the 1930s' inventory.

HABITAT-TYPE GROUPS AND COVER-TYPE REPRESENTATION

The habitat type of a piece of ground and habitat-type groups do not change over time (Table III-11) except in extreme circumstances. However, the cover types existing on any habitat-type group can and do change with succession, human activities, fires, insect infestations, and diseases. Table III-7 shows the representation of cover types on habitat-type groups for Coal Creek State Forest.

On Coal Creek State Forest in the predominant habitat-type group, the cool and moist group, a major shift has occurred from lodgepole pine to subalpine and mixed-conifer cover types. Others that are decreasing on the cool and moist habitat-type group include western larch/Douglas-fir and Douglas-fir habitat types.

STRUCTURAL CHARACTERISTICS

Current structural characteristics are defined as single-storied, two-storied, multistoried, or even-aged clumps. Within Coal Creek State Forest, 6,588 acres are in single-storied stands, 925 acres are two-storied stands; 5,420 acres are multistoried

TABLE III-11 ACRES OF COVER TYPES FROM THE CURRENT INVENTORY BY HABITAT-TYPE GROUPS

Cover Type	Moderately Warm and Dry	Moderately Cool and Dry	Cool and Moist	Wet	Moderately Cool and Moist	Cool and Moderately Dry	Totals
Subalpine			3,161	52		686	3,899
Douglas-fir	357	637	20		45	193	1,253
Lodgepole pine	37	83	1,652	12	60	1,956	3,801
Mixed conifer			2,766	906			3,671
Nonstocked			49			26	75
Western larch/ Douglas fir	209	427	806			371	1,813
Western white pine			529			52	581
Totals	604	1,147	8,984	970	105	3,285	15,094

TABLE III-12 CURRENT PATCH SIZE AND SHAPE BY COVER TYPE

Cover Type	n*	Mean Patch Size	Standard Deviation Patch Size	Mean Patch Shape	Standard Deviation Patch Shape
Subalpine	22	177	294	1.68	0.69
Douglas-fir	18	70	66	1.45	0.20
Lodgepole pine	26	146	312	1.58	0.63
Mixed conifer	15	245	423	1.88	0.70
Nonforest	4	61	50	1.47	0.46
Water	1	23	N/A	2.66	N/A
Western larch/ Douglas-fir	26	70	66	1.47	0.33
Western white pine	7	83	71	1.71	0.46
Nonstocked	4	19	13	1.20	0.24
Total	123	125	248	1.59	0.55

*Number of patches

TABLE III-13 CURRENT PATCH SIZE AND SHAPE CHARACTERISTICS BY AGE CLASS

Age Class	n*	Mean Patch Size	Standard Deviation Patch Size	Mean Patch Shape	Standard Deviation Patch Shape
0-39	44	37.7	47	1.30	0.28
40-99	27	208	487	1.68	0.69
100-149	34	74	87	1.58	0.44
150+	15	354	923	2.04	1.44
Total	122	126	408	1.56	0.70

*Number of patches

stands, and 2,085 acres are in stands made up of even-aged clumps. In the 1930s' inventory, the only structural measure was tied to age, so meaningful comparisons to past conditions cannot be made.

CURRENT PATCH CHARACTERISTICS

Current patch characteristics indicate Coal Creek State Forest has become considerably more fragmented since the 1930s. There are 121 distinct cover-type patches currently, versus 45 historically **(Tables III-8 and III-12)**. The same trend is apparent with age-class patches, with a current 128 patches and a historic 45 patches **(Table III-13)**. One likely cause for much of the fragmentation is a simple artifact of mapping unit size and precision of mapping. For example, the minimum map unit size in the historical inventory was 40 acres, whereas today the minimum size for mapping is 5 acres. This dissimilarity explains some of the differences in patch sizes when one knows that 73 of the current age class patch sizes are under 40 acres and 61 of the cover type patches are smaller than 40 acres. In the 1930s' inventory those patches would have been absorbed by adjacent or surrounding larger patches.

STAND VIGOR

Stand vigor is improved when slow-growing, diseased, or insect-infested trees or stands are harvested and replaced with new growth through regeneration.

The 4 generally recognized vigor classes are: full, good-to-fair, fair-to-poor, and very poor. These vigor classes are defined in Coal Creek State Forest SLI.

- Full vigor - Forests have an open canopy and growth is optimal. An example of this type of stand would be young, immature, and probably in the seedling or sapling stage. Only 240 acres within Coal Creek State Forest are at full vigor.

- Good-to-fair vigor - Stand canopies are mostly closed with crown ratios (the vertical height of a tree's crown compared with the total vertical height of the tree) between 33% and 50%. Growth rates exceed mortality. This type of stand would be young, merchantable sawtimber. Good-to-fair vigor stands occupy 8,438 acres in Coal Creek State Forest.

- Fair-to-poor vigor - Stand canopies are tightly closed with crown ratios less than 33%. Growth and mortality rates are nearly balanced. An example of a stand would be an old stand of merchantable sawtimber. Fair-to-poor vigor stands occupy 6,142 acres in Coal Creek State Forest.

- Very poor vigor - Stands are similar to the fair-to-poor class, but generally are in a decadent condition caused by competing vegetation, insects, diseases, and/or old age. Typically, mortality rates exceed growth rates. Poor vigor stands occupy 197 acres in Coal Creek State Forest.

INSECTS AND DISEASES

Bark beetles, armillaria root rot, dwarf mistletoe, white pine blister rust, and Indian paint fungus are the main insects and diseases that occur within these habitat-type group. Root diseases play a major role in regulating stand composition and stocking forest types in the area (Monnig and Byler 1992). Under natural conditions, Douglas-fir and true firs tend to be susceptible to root diseases. Stands dominated by the more-resistant species, such as western larch and western white pine, are perpetuated where root disease is present.

INDICATORS OF "OLD-GROWTH' ATTRIBUTES

- *"Old-Growth" Attributes of Old Stands*

  As displayed earlier, a total of approximately 5,306 acres of Coal Creek State Forest are currently classified as "old growth". However, information on stand age alone is insufficient to describe many of the attributes commonly associated with old age. We recognize that our desired management strategy under the SFLMP is to retain, in reasonable proportions, stands that contain all the naturally occurring combinations of attributes, including those associated with old-aged stands.

  We lack surveys specifically oriented to elucidating all the stand characteristics that would characterize "old-growth". However, we did derive indices from data in DNRC's Stand-Level Inventory that summarized the abundance of 4 attributes that often, albeit not always, characterize stands in the latter stages of development: large live trees, snags, coarse down-woody material, and decadence among live trees. In each case, we used standardized procedures (see Appendix D - Old Growth Attribute Model) that integrated information from more than 1 field in the SLI to produce a single index.

Briefly, the "large tree" index measures the relative abundance of trees more than 21" in diameter. The snag index measures the relative abundance of dead trees, with greater weight given to larger diameter snags, but equal weight given to snags by their species and other characteristics. Similarly, the coarse woody debris (CWD) index measures the relative abundance of down woody material, with greater weight given the larger diameter logs, regardless of species or degree of rot. Finally, the decadence index is taken directly from the Stand-Level Inventory's estimate of stand "vigor", with stands that show poor growth relative to mortality given the highest value for decay.

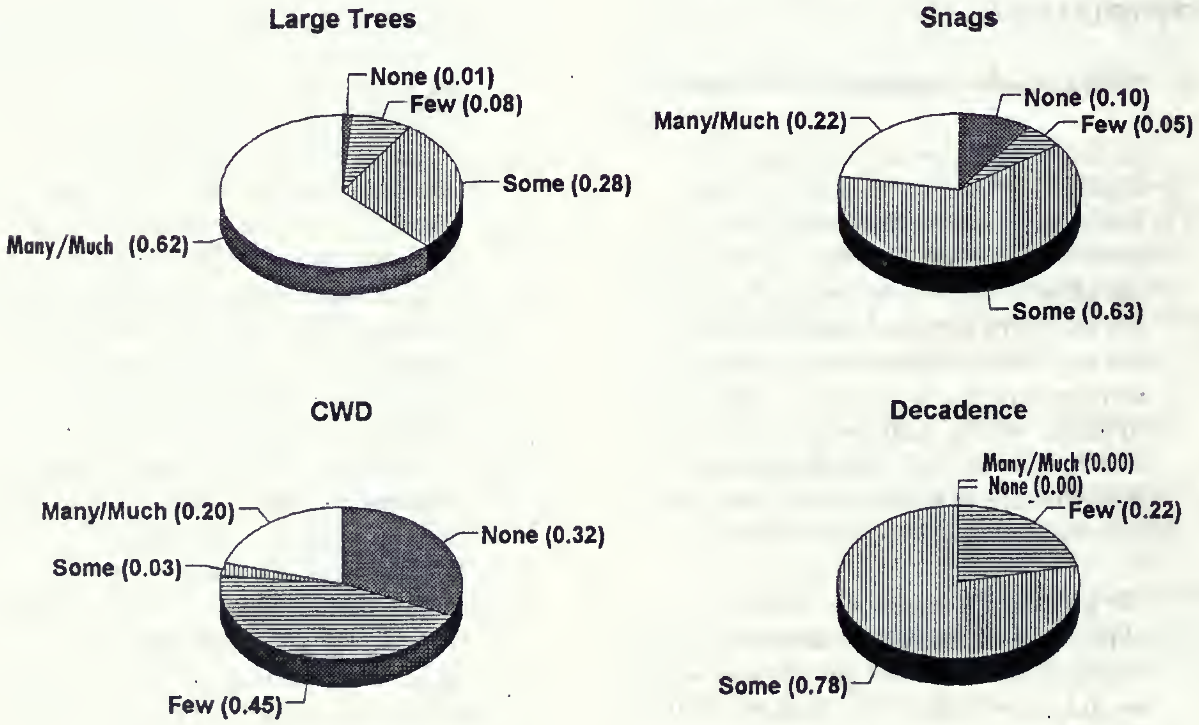
In each case, we used only 4 categories of abundance, which corresponded roughly to the 4 adjectives: "none", "few" (or "little"), "some" (i.e., a 'typical' amount for a stand of that forest type and age, neither particularly few or many), and "many" (or "much"). This description is necessarily crude: we cannot describe existing conditions or model future effects with greater resolution than our current inventory allows. However, our understanding of the naturally-occurring abundances and dynamics of these old-growth attributes is similarly crude. Thus, even were a more precise description or assessment possible, we are unsure the additional resolution would be informative. We believe, moreover, that despite their inevitable approximations, these descriptions and assessments are generally accurate and objective and serve as useful proxies to guide our more general evaluation of diverse forest types and structures.

Fig. III-5 displays the acreage of all stands categorized as "old" that fall into the categories "none", "few", "some", and "many/much" for attributes "large trees", "snags", "coarse woody debris", and "decadence". Over 60% of old-growth acreage currently has many large, live trees, with considerably less having "some" (28%), or "few" (8%). Most (63%) acreage of old growth was categorized as having a moderate abundance (i.e., "some") of snags, with less having many (22%), none (10%), and few (5%). Coarse-woody debris was either relatively rare on the Coal Creek State Forest, or, alternatively, the categorization system tended to rate stands in the lower categories. In either case, only 20% of acres in the "old growth" class were categorized as having "much" CWD, and about 77% was categorized as having either "none" or "little". The vast majority of old-stand acres were categorized as having a moderate (i.e., "some") amount of decadence (78%), with most of the remainder categorized as having "little".

Fig. III-5 Acres of existing "old" growth in Coal Creek State Forest, by category of abundance for the 4 attributes often associated with the term "old growth":

- presence of large-diameter live trees,
- snags,
- coarse woody debris, and
- decadence, as indicated by the absence of tree vigor.

Acreage totals differ among attributes because of missing data on some stands.

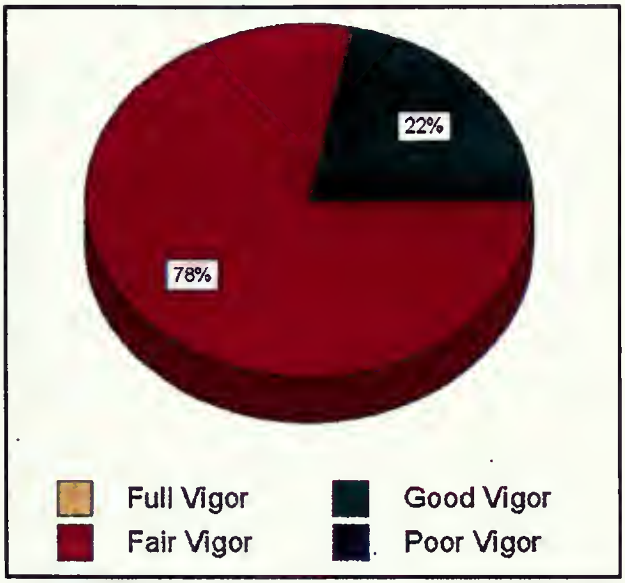


• *Vigor of Old-growth Stands*

Vigor of old-growth stands can be used to indicate relative decadence. Low-vigor old growth are more likely to have large trees, more snags, and greater amounts of large down woody debris than would be expected with high-vigor stands. Figure III-6 shows the vigor classes by percentage for old growth on Coal Creek State Forest. As would be expected, no old-growth stands are at full vigor. Most stands are in the fair-vigor class. None of the old growth on Coal Creek State Forest is of poor vigor.

Stands having good to fair vigor are likely to remain relatively stable for the next several decades. Some trees would continue to die, maintaining the presence of snags and large down logs. In stands with poor vigor, mortality is currently exceeding growth. These stands would probably continue to decline.

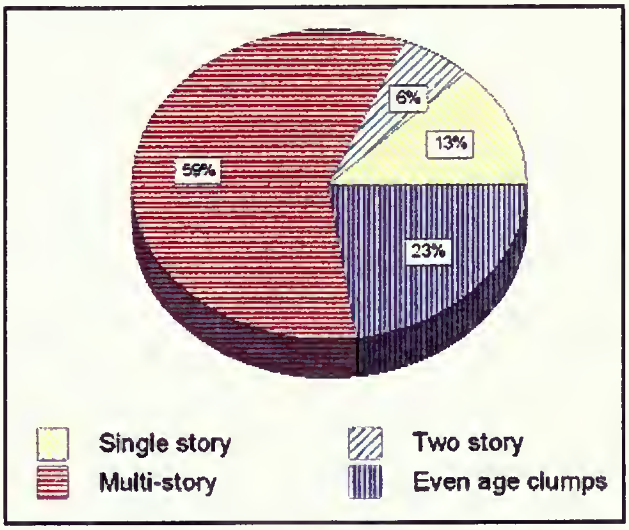
Figure III-6 Old Growth Vigor on Coal Creek State Forest



• *Structure Of Old-Growth Stands*

The structure of forested stands indicates one characteristic often associated with "old growth", namely whether or not the stand is in a multistoried condition. The multistoried condition arises when a stand has progressed through succession to the point that shade-tolerant species are replacing a shade-intolerant overstory. It can also occur when a stand is already dominated by large old shade-tolerant species; through gap replacement, the regeneration that occurs is also shade tolerant. The former is the more common case in forests of Montana. In both cases, the time since a major disturbance tends to be long, helping to create many of the attributes important in old growth.

Figure III-7 Structure of old Growth on Coal Creek State Forest

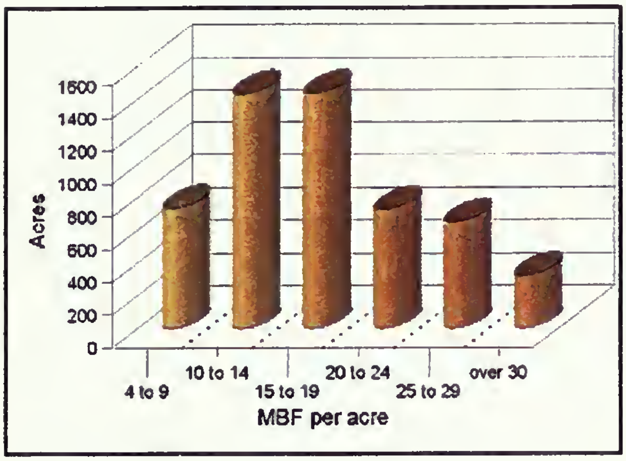


Current conditions on Coal Creek State Forest show old-growth stands are predominantly multistoried, 59% of all old-growth stands (Figure III-7). Single-storied stands generally reflect even-aged conditions following a stand-replacement disturbance, while the multistoried condition is generally representative of an uneven-aged condition.

• *Volume in Old Growth Stands*

Another attribute of old growth often deemed important and for which distributions can be quantified and effects assessed is a measure of density, or stocking. In this case, the stand board-foot volume per acre is used (See Figure III-8). Higher volumes indicate more densely stocked stands. One value of this measure is that effects of ingrowth and lack of wildfires are minimized because only trees larger than 9 inches dbh are included. Thus, it becomes a measure or barometer through which impacts on the character of old growth can be measured.

Figure III-8 old Growth Stand Volume per Acre on Coal Creek State Forest



Currently, 54% of old-growth stands carry moderate volumes of 10 to 19 MBF per acre; 32% contain over 20 MBF per acre.

CURRENT FOREST CONDITION SUMMARY

The data indicate that forest succession is playing a major role in shaping the stands of Coal Creek State Forest. The representation of lodgepole pine has decreased from over 47% of the forest to approximately 25%. At the same time, the mixed conifer and subalpine types have increased 52% and 28%, respectively.

Quantification of appropriate conditions suggests Coal Creek State Forest should be dominated to a far greater extent by the western larch/Douglas-fir cover type than is currently the case. The appropriate condition shows that representation of the western larch/Douglas-fir cover type should be about 42%, versus a current condition of about 12.5%. Appropriate conditions also suggest that the mixed-conifer and subalpine types are overrepresented on Coal Creek State Forest by 266% and 215%, respectively. The overrepresentation of these shade-tolerant cover types reflects the lack of disturbance and effects of forest succession.

Old-growth acreage has slightly increased since the 1930s, from 32% to 35% of Coal Creek State Forest. Overall, it has 5,306 acres of old growth (with a range of structural attributes commonly associated with the popular term 'old growth'). The minimum acres of old growth required to meet our SFLMP commitments is 2,142 acres. Thus, in the big picture, Coal Creek State Forest has well over twice as many acres of old growth than is our minimum commitment.

However, 69% of all old-growth stands are in the shade-tolerant mixed-conifer and subalpine cover types. This large overrepresentation of old shade-tolerant cover types has caused the western larch/Douglas-fir cover type to be underrepresented, largely through the effects of succession. Currently, Coal Creek State Forest has 602 acres of old western larch/Douglas-fir, versus a required minimum of 1,490 acres. There are only 2 ways to correct this shortage:

- through conversion of other types via partial harvesting, or
- allow younger western larch/Douglas-fir stands to become old.

Patch-size analysis indicates that the Coal Creek State Forest has decreased patch sizes, especially in the 0-to-40 and old-stand age classes. Patch shapes have become slightly more complex since the 1930s. The patch analyses compare data derived using different mapping procedures, so is not the 'cleanest' of comparisons. However, the general trend of decreased patch size in both cover types and age-class patches is probably real. The actual magnitude, though, may differ from that shown in the analyses.

The information shows a forest in the early stages of, but still heavily affected by, forest succession resulting from effective fire suppression and lack of wildfires. Given the shifts in cover types, the potential for large catastrophic fires and increased loss due to insects and diseases is high.

APPROPRIATE CONDITIONS

Appropriate or desired future conditions are described for cover-type representation. Additionally, old-growth minimums and an old-growth recruitment schedule are displayed for Coal Creek State Forest.

RELATIONSHIP TO SFLMP OLD-GROWTH COMMITMENT

The SFLMP requires the maintenance of old growth in amounts equal to at least one-half of that expected to occur with natural conditions (see Old Growth Commitments from the SFLMP). This section describes how to determine that minimum. The management for old-growth amounts is best conducted for the entire Coal Creek State Forest to avoid homogeneous forests spread across the landscape with equivalent proportions of cover types and age classes in each. Such an approach also facilitates the development and maintenance of large blocks of contiguous old growth and provides for the mechanisms to maintain and enhance connection between old growth.

COVER-TYPE REPRESENTATION AND OLD-GROWTH MINIMUMS

To determine appropriate conditions, a set of filters was developed to use on our SLI. As a first step, this procedure looks at current species representation to determine what would be an appropriate condition in terms of cover-type representation across the entire Coal Creek State Forest. See Fig. III-4 for the appropriate number of acres of old growth on Coal Creek State Forest.

Table III-14 describes the protocol for assigning appropriate cover types from our current inventory. Stands are evaluated against the criteria in the table beginning with white pine and proceeding down the Cover Type column. Once assigned, a stand is not evaluated against other cover-type criteria.

The minimum proportions of old-growth stands to be retained, by cover type, are calculated by multiplying the appropriate proportion of cover types by one-half the proportion of each cover type that historically existed as old stands at the climatic section level. The product is then multiplied by the forested acres (15,094) of Coal Creek State Forest

TABLE III-14 PROTOCOL FOR ASSIGNING APPROPRIATE CONDITIONS BY COVER TYPES

Cover Type*	**Proportional Representation (%) of Species in Each Cover Type**				
	Ponderosa Pine	**Douglas-fir**	**Western Larch**	**Western White Pine**	**Lodgepole pine**
Western white pine				≥10	
Ponderosa pine	≥20				
Western larch/Douglas-fir		Western larch/Douglas-fir ≥30 (western larch present)			
Douglas-fir		≥50			
Lodgepole pine					≥40
Subalpine types	Habitat type >630 and stands not yet assigned				
Mixed conifer	All remaining stands				

*Nonstocked stands assigned to western larch/Douglas-fir cover type; types were assigned in the order listed. Once assigned a stand was not subjected to subsequent assignment criteria.

to indicate the minimum acres of old-growth stands to maintain. (See Figure III-18 - Old Growth By Cover Type on Coal Creek State Forest.)

Cover types were assigned from DNRC's current SLI to cover types matching those described in the historical data. Table III-16 takes the minimum proportions from Table III-15 and multiplies them by the forested acres in Coal Creek State Forest to determine the minimum acres of old growth to maintain in particular cover types (see Fig. III-2). Also shown is the current representation of old growth. As shown in Table III-16, there are sufficient acres of old growth in all cover-type classes, except the lodgepole pine and western larch/Douglas-fir.

TABLE III-15 MINIMUM PROPORTION OF COAL CREEK STATE FOREST TO MAINTAIN AS OLD GROWTH FOR EACH COVER TYPE (The average proportion indicates the proportional area determined using the SLI)

Cover Type	Appropriate Proportion of Area (%)	Old-Stand Percentage Losensky*	One-half of Losensky's Percentage	Minimum Percentage of Area to Manage as Old Growth
Ponderosa pine	0	74	37	0
Douglas-fir	8	6	3	0.24
Western larch/ Douglas-fir	42	47	23.5	9.87
Western white pine	4	17	8.5	0.34
Lodgepole pine	24	5	2.5	0.60
Mixed conifer (Spruce/fir)	9	43	21.5	1.94
Subalpine	12	20	10	1.20
TOTAL				14.14

*The old-stand proportion from Losensky is the proportion of each cover type that was over 170 years old for ponderosa pine, Douglas-fir, and western larch/Douglas fir; over 140 years for lodgepole pine; and over 180 years for the other types.

TABLE III-16 THE MINIMUM NUMBER OF ACRES TO BE MAINTAINED AS OLD GROWTH FOR EACH COVER TYPE IN COAL CREEK STATE FOREST*

Cover Type	Percentage to Manage as Old Growth	Minimum Acres to Maintain as Old Growth	Existing Acres of Old Growth
Ponderosa pine	0	0	0
Douglas-fir	0.24	36	710
Western larch/Douglas-fir	9.87	1,489	618
Western white pine	0.34	56	443
Lodgepole pine	0.60	91	0
Mixed conifer	1.94	299	2,277
Subalpine	1.20	188	1,258
TOTALS	14.14	2,159	5,306

*There are 15,094 forested acres on Coal Creek State Forest

OLD-GROWTH-RECRUITMENT SCHEDULE

The SFLMP calls for the maintenance of sufficient acres to replace old growth that may fall apart, die, or burn. The proportions were calculated using a Weibull function for age-class distribution. The Weibull function uses both the fire return interval and a shape parameter to fit the age-class curve. This curve indicates the proportion of stands needed in each age class. Table III-16 shows the cover types and percentages of stands needed in the 110-year and younger age classes and the percentages necessary for the age classes between 110 and 150 years. Age classes cover 10 years (e.g. the 110 class is from 110 to 119 years).

None of the cover types are currently short of old-stand recruitment acres. Both western larch/Douglas-fir and lodgepole pine cover types are short of existing acres of old growth.

TABLE III-17 OLD-GROWTH RECRUITMENT SCHEDULE

Cover Type	Old Growth Minimum Percentage	Minimum Percentage in the 110 Class and Each of the Younger Classes	Minimum Percentage in Each Age Class Between 110 and 150[1]
Ponderosa pine[2]	--	--	--
Douglas-fir	3	2.4	1.0
Western larch/ Douglas-fir	23.5	3.5	2.6
Western white pine	8.5	3.2	1.8
Lodgepole pine[3]	2.5	1.8	0.9
Mixed conifer	21.5	3.5	2.6
Subalpine	10	3.3	1.9

[1] The 150-year age class is used because in DNRC inventory that class corresponds best to Losensky's old-stand designations.
[2] Ponderosa pine - no stands are present on Coal Creek State Forest.
[3] Lodgepole pine becomes old growth at 140, so the 0.8 refers to the 110-year to 140-year age classes.

NOXIOUS WEEDS

EXISTING NOXIOUS WEEDS

Spotted Knapweed (*Centaurea maculosa*) occurs along portions of existing roads, mainly on southerly aspects and dry sites, within the project area. There is less ground cover and above-average erosion where knapweed is the dominant vegetation.

SOIL

GEOLOGY AND SOIL TYPES

Bedrock in the proposed project area is composed mainly of argillites and limestones formed during the Precambrian era. Some terrace footslopes above the North Fork of the Flathead River have inclusions of tertiary siltstones. There are no areas of especially unique geology located within the proposed project area. The project area does contain some localized areas of slope instability.

The Coal Creek valley is a U-shaped trough formed by alpine glaciation. Soil types in the main stem of Coal Creek valley are deep calcareous gravelly silt loams derived from glacial till on the lower slopes. The depth of till becomes shallower on the mid to upper slopes, giving way to residual soil weathered from bedrock on the upper slopes and ridge tops. Soils in the valley bottom are alluvial soils deposited from glacial outwash and river flows. Soils in the Cyclone Creek valley were similarly formed, but the rock materials weathered are not calcareous, which means they may not be as fertile or productive as calcareous soils. Soil types on the east face of Winona Ridge were formed from the glacial till of the continental glaciers that came down from Canada. This glacial till is composed of clay and silt formed and deposited prior to the last glaciation.

A landtype map is enclosed (see Appendix B, Soils Map) along with a brief table describing some of the management interpretations associated with these landtypes. More detailed descriptions are available in the FNF Land Inventory.

ROADS

Roads to the proposed project area are mainly of low to moderate standard and would need varying degrees of improvement to meet current Best Management Practices (BMPs). The main, open access roads into the Coal Creek and Cyclone Creek basins are of moderate standard, but lack adequate surface-drainage features to meet current BMPs. Numerous miles of closed roads in both the main stem of the Coal Creek watershed and the existing closed-road system on the east face of Winona Ridge are in a variety of conditions. Some of the existing problems with these roads include:

- inadequate surface-drainage and ditch-relief structures
- improperly designed stream crossings, and
- numerous small cutslope failures.

EFFECTS OF PAST ACTIVITIES TO SOIL PRODUCTIVITY

Much of the past timber-harvesting activities in the proposed project area has taken place on moderate to gentle slopes. Where ground-based yarding methods were used, dispersed skidding patterns occurred. Main trails in these units were spaced approximately 120 feet apart and are still identifiable. The minor and more dispersed trails are no longer evident after recovery of vegetation. Some displacement has occurred on these trails, effectively removing the shallow silt loam topsoil. These trails are neither revegetating nor actively eroding. In places where past harvesting was completed on the steeper slopes, a cable yarding system was used that generated a negligible impact to soil productivity.

A localized area of marginal slope stability occurs in the SW1/4 of Section 30, T34N, R21W. A narrow debris-flow-type slope failure occurred in a forested site due to a combination of factors, including dense glacial till subsoil on steep sideslopes and a concentration of water directed onto the slope. Another area of marginal slope stability exists in the SW1/4 of Section 11, T34N, R21W. This slope failure appears to be a result of subsurface water softening compacted glacial till and siltstone on steep slopes near an existing road location. Evidence of past slope instability on the east face of Winona Ridge is apparent in several places.

NATURAL AREA

The Montana Natural Areas Act of 1974 (as amended in 1987) called for the creation of a Statewide system of natural areas, which could include land managed by any State agency. Such areas were to be those "*...affected primarily by the forces of nature with the visual aspects of human intrusion not dominant and also...having one or more of the following characteristics: (a) an outstanding mixture or variety of vegetation, wildlife, water resource, landscape, and scenic values; (b) an important or rare ecological or geological feature or other rare or significant natural feature worthy of preservation for scientific, educational, or ecological purposes...*" (MCA 76-12-104, pp. 1327-1328).

As part of a draft management plan for the Cyclone Lake bald eagle nesting territory proposed for the FNF and DNRC, McFadzen (1989) recommended that "Cyclone Lake should be evaluated for Natural Area designation". She cited, in addition to the eagle nest, the presence of pure-strain westslope cutthroat trout, the diversity of habitats, and a long list of species known or suspected to be present as justifying such an evaluation. These recommendations, as well as the list of birds and mammals observed during her eagle study, was repeated in McFadzen (1992).

Considerable interest in the possibility of designating all or part of Cyclone Basin as a natural area was kindled in 1992 by the proposal of the Department of State Lands (now DNRC) to salvage insect-infested timber on Winona Ridge. This resulted in a series of meetings and field tours and the development of unpublished maps that provided a bit more detail than existed at that time on the local presence and location of unusual species (e.g., common loon [*Gavin imper*], pileated woodpecker [*Dryocopus pileatus*], sora [*Porzana carolina*], barred owl [*Strix varia*]). However, no formal assessment of the appropriateness of designating a natural area in Cyclone Basin or anywhere else in Coal Creek State Forest was conducted at that time, nor was it clarified exactly what such a process would require. When the proposed timber sale was dropped, discussion and assessment of a possible natural area in or around Cyclone Basin became a low priority for all involved. With the proposal to again conduct some type of revenue-generating and/or forest-management project in Coal Creek State Forest, the issue of a possible Natural Area has again come to the forefront. Because the pertinent laws provide little guidance beyond the quote printed above as to what qualifies an area for natural area designation, DNRC has, to date, conducted no formal surveys of Cyclone Basin or Coal Creek State Forest designed specifically to "evaluate" the possibility beyond that 1992 work.

In an effort to evaluate occurrences of sensitive plants in the project area, DNRC biologists have visited the area several times, database information has been secured from the Montana Natural Heritage Program (MTNHP), and a survey for rare and sensitive plants has been conducted (see Project File). The MTNHP database shows that the following plants of special concern have been previously identified within the Demers Ridge and Cyclone Lake quadrangles: Demers Ridge (4811462) - *Eriophorum gracile* and *Petasites frigidus var nivalis*; Cyclone Lake (4811463) - *Botrychium crenulatum*, *Dryopteris cristata*, *and Halenia deflexa ssp deflexa*. Results of the survey showed that none of the plants listed in the MTNHP database were idenfied in the Cyclone/Coal project area.

From these sources, in addition to information provided by McFadzen (1992) and by the public responding to the 1992 timber harvest proposal, we believe it safe to summarize the Cyclone Basin as having very high natural values. Contrary to the impression one gains from a view of maps and aerial photos, Cyclone Basin appears to maintain an essentially isolated character. Clearly, the fact that breeding pairs of both bald eagles and common loons are maintained on the lake speaks to the fact that it is, for lack of a more technical description, "quiet". (Both bald eagles and common loons are known for being sensitive to disturbance, whether it be mechanical [i.e., road building, logging], or merely the presence of people [e.g., roads, recreationists]). Given the amount of roading in the North Fork and Whitefish range in general, this "quiet and secluded" character is probably the most important single aspect. Older cuts appear to be quite jarring when viewed from Cyclone Peak or aerially; however, because they are regenerating and are quite brushy, they do little to alter the generally pristine character of the basin when viewed from ground level.

We are not aware of species or habitats within Cyclone Basin that are unique to that area. The combination of species is certainly noteworthy, but it is beyond a purely scientific determination as to whether the mixture or variety is "*outstanding*", and/or whether the ecological features qualify as "*important or rare*". Thus, we believe that designation of a natural area ultimately requires a management decision encompassing all the pertinent laws, regulations, mandates, values, and interests, rather than being amenable to a strictly scientific assessment.

Pertinent to such consideration (now, as well as in 1992), is Attorney General Opinion 92 (July 7, 1976), which states:

> "*So that the state will not commit a breach of trust under the Enabling Act and Montana Constitution, the state must actually compensate its school trust in money for the full appraised value of any school trust lands designated as or exchanged for natural areas pursuant to the Montana Natural Areas Act of 1974. Such compensation can only be avoided by securing the consent of Congress*". [Report of the Attorney General of the State of Montana, Vol. 36, p. 514]

Opinion 92 carries with it the force of law until or unless a court decision specifically alters it. Thus, designation of a natural area requires monetary appraisal and compensation.

As part of the scoping and initial analyses for this project, the DNRC staff discussed the potential, possibility, and advisability of designating a natural area in part of Coal Creek State Forest, both internally and with a number of interested groups and individuals. This scoping indicated that, given the 1976 Opinion, it is not appropriate to include a natural area proposal as a separate alternative or as part of another Alternative *at the current time*. However, decisions made as part of this project do have the potential to influence the potential for a natural area to be designated at some *future time*. Thus, under each of the alternatives, we assess effects on the potential of a future natural area designation in Chapter IV.

WILDLIFE

DNRC recognizes that it is an impossible and unnecessary task in assessing the existing status of, or evaluating the effects of proposed actions on, all wildlife species and their specific habitats in the project area. We assume that if landscape patterns and processes similar to those that species evolved with are maintained, then the full complement of species will be maintained across the landscape. We manage State trust lands to maintain or restore a semblance of historic conditions *on DNRC lands* and make reasonable attempts to pursue cooperative planning with major adjacent landowners (DNRC 1996). This 'coarse filter' approach supports diverse wildlife populations by managing for a variety of forest structures and compositions that approximate historic conditions across a landscape. Here, we review the analysis of impacts on vegetation and landscapes with a view toward effects on wildlife.

Recognizing that our fundamental approach uses the "coarse filter", we acknowledge that it is often difficult to ensure that such a broad view sufficiently considers all the important habitat elements that may be affected by any given project. Thus, in addition, we also evaluate individual species and habitats which are recognized to be of special concern, or which, because of specific habitat affinities, assist us in using our "coarse filter" (i.e., a 'fine-filter analysis'). These are the species and habitats that are addressed below. They include wildlife species Federally listed as 'threatened' or 'endangered', species listed as 'sensitive' by DNRC, and species managed as 'big game' by DFWP.

COARSE-FILTER ASSESSMENT

Although a complete inventory is lacking, it is likely that all native terrestrial vertebrates that were present prior to arrival of European mankind currently use Coal Creek State Forest. Large vertebrates (that, however, are often extirpated when mankind's presence becomes too evident), such as grizzly bears, wolves, lynx, and wolverines, make use of habitats on Coal Creek State Forest. Invertebrate fauna is insufficiently studied; if any species are lacking, they are likely to be habitat specialists dependent on those elements of biodiversity currently under threat in the area (e.g., whitebark pine, western white pine, and burned forests). Wildlife habitats in Coal Creek State Forest benefit from their location within the relatively pristine North Fork of the Flathead River Valley and its proximity to Glacier National Park. Wildlife habitats in Coal Creek State Forest are also characterized by a heterogeneous mix of stands and structures and relatively low levels of human use.

As in most western Montana forests, fire has been uncharacteristically infrequent during the past 50 years due to suppression activities. However, as noted in the Vegetation Analysis (see Table III-11 Habitat-Type Groups), cool and moist habitat types constitute a higher proportion of Coal Creek State Forest than is true for western Montana as a whole. Fire regimes in these habitat types tend to be of the infrequent, stand-replacing variety. Thus, the lower-than-characteristic frequency of fires during the past half-century has had a less dramatic effect here than in areas characterized by warmer, drier habitats. Still, fire-dependent or fire-associated species (e.g., black-backed woodpecker [*Picoides arcticus*]) are probably been less abundant in Coal Creek State Forest currently than would typically have been the case under a more natural fire regime. Browse for big-game species may also exist in lower quantity and quality than would have been the case were fire allowed its natural role.

COVER TYPE CHARACTERISTICS: EFFECTS ON WILDLIFE

Although relatively long fire-return intervals have limited the effects of fire-suppression relative to other areas in western Montana, the vegetation analyses demonstrate that current conditions differ from those that evidently characterized Coal Creek State Forest historically. Mixed-conifer (often shade-tolerant species) and subalpine types have generally increased at the expense of fire-associated lodgepole pine and fire-resistant western larch. This has probably benefited some species that are adapted to forests dominated by Englemann spruce and subalpine fir, but hurt species for which lodgepole- or larch-dominated forests provide appropriate niches. The shade-tolerant species generally provide better snow intercept than do the shade intolerants, thus favoring species that have trouble with deep snow. Conversely, shade intolerants (notably western larch) are often well-adapted to fire, having thick bark that allows the presence of heart-rot without weakening the entire tree, thus providing excellent raw materials for cavity-dependent species. Western white pine has declined throughout much of its range, although the vegetation analysis above does not demonstrate this clearly for Coal Creek State Forest. Missing from the analysis (because of approximations in the raw data) are indications that white-bark pine has also declined in health and abundance, but we know that this is almost certainly the case within those limited areas of Coal Creek State Forest where it normally grows. Species, such as grizzly bears and Clark's nutcrackers (*Nucifraga columbiana*), which feed on the seeds of this tree, have probably been negatively affected by this decline.

STAND AGE CHARACTERISTICS: EFFECTS ON WILDLIFE

Fewer fires during the past half-century have generally decreased the abundance of younger forest types and nonforested openings, with a consequent increase in the abundance of stands in the 40-to-100-year class (Tables III-3; Table III-9). Unlike in many other areas (including much of the adjacent FNF), the abundance of older forests appears to be quite similar to those that characterized the area historically. Thus, species that thrive in older forests (e.g., brown creeper [*Certhia familiaris*]) have probably done well (although see the section below on patch size and amount of edge), while species that thrive in younger, more open forests or temporary forest openings (e.g., mountain bluebird [*Sialia currucoides*]) have probably suffered.

PATCH CHARACTERISTICS: EFFECTS ON WILDLIFE

Species that occupy large home ranges or that do not easily cross inhospitable habitats can also be sensitive not only to the amount of appropriate habitat, but also to its spatial configuration. Thus, patch size can influence wildlife population dynamics. Additionally, some species are adapted to taking advantage of the diversity of habitats that occur near patch edges (for example, where a closed-canopy forest abuts a recently burned, younger forest). Other species are adversely affected by the presence of edge (or by the presence of animals that do thrive in edges), and thus thrive only near the interior of relatively homogeneous patches. Patch shape is correlated with how much edge a patch has, given a constant area.

The vegetation analysis (see PATCH CHARACTERISTICS) demonstrated that the number of distinct patches in Coal Creek State Forest has increased from the 1930s and patch size has generally decreased, particularly among old stands. Patch size among 150+-year-old stands has declined three to fourfold (Tables III-8 and III-13). Patch shape among old stands has also evidently become more complex (although some of this added complexity may simply reflect more precise mapping of stand boundaries in the modern inventory). As a result, habitat conditions within old forests that are far from edges and/or younger conditions (so-called "interior" conditions) have become increasingly rare.

SPECIAL HABITATS

Several areas within Coal Creek State Forest are noteworthy for unusual habitat features:

- South of Coal Creek in Sections 34 and 35 is a swampy area that probably provides habitat for mink (*Mustela vison*), red-winged and yellow-headed blackbirds (Agelaius phoeniceus, Xanthocephalus xanthocephalus) and other marsh-associated species. This area has not been modified in recent decades by human activity.

- The outlet from Cyclone Lake takes a slow-moving form and is evidently responsible for an unusual thermal regime in downstream Cyclone Creek. An unusual assemblage of invertebrate species is present in this reach of the creek, which may be responsible for the downstream spawning of native bull and westslope cutthroat trout (Dan Vincent, Montana Fish Wildlife and Parks, personal communication, October 3, 1997).

- Finally, the location and relative inaccessibility (to people) of Cyclone Lake and its surrounding mesic forests provides for an unusually rich combination of vertebrate species. There are few areas, even in national parks, not to mention highly managed forests, where one can easily observe bald eagles, ospreys, common loons, beavers, river otters, elk, mule deer, and moose within a small area. While not so easily observed, grizzly bears, wolves, lynx, and fishers are also known to use the area.

FINE FILTER ASSESSMENT

The analysis area for special habitats and most of the wildlife species is generally the Coal Creek State Forest (the grizzly bear analysis area is larger than the Coal Creek State Forest). For most of the species listed below, the State forest provides only a portion of their life requisites for space and resources. Fortunately, Coal Creek State Forest is a component of a much larger natural and social environment that currently sustains its entire pre-Columbian indigenous fauna. The viability of this system is enhanced by its connection to additional USFS lands to the south and Canadian forests to the north.

THREATENED AND ENDANGERED SPECIES

Four terrestrial wildlife species are Federally listed as threatened or endangered in northwest Montana: grizzly bear, wolf, bald eagle, and peregrine falcon.

PEREGRINE FALCON (*Falco peregrinus*)

In the West, peregrines typically nest on mountain cliffs or in river gorges (USFWS 1984). Neither existing (MNHP 1996) nor potential nesting habitat exists in the project area. Foraging habitats are usually open areas such as marshes, estuaries, and croplands. Although there are no resident peregrine falcons in the project area, migratory falcons may seasonally use the area, particularly along Winona Ridge.

BALD EAGLE (*Haliaeetus leucocephalus*)

The bald eagle is classified as threatened in Montana under the U.S. Endangered Species Act. DNRC (under its former name, Department of State Lands) is a signatory to the 1994 Montana Bald Eagle Management Guidelines (MBEMG 1994). An eagle nesting territory has existed near Cyclone Lake since at least 1972 (and possibly decades earlier; McFadzen 1992), and those eagles are the primary concern for management activities in Coal Creek State Forest.

A document including management guidelines for this nesting territory was drafted in 1989, and finalized in 1992 (McFadzen 1992). DNRC has informally accepted the timber-management guidelines in McFadzen (1992) since its completion (T. Vars, correspondence, April 1, 1996), although DNRC has not been able to actively implement the suggested recommendations related to recreational use. On March 6, 1998, Stillwater Unit Manager, R. L. Sandman, notified Dennis Flath, DFWP, who coordinates Statewide eagle management plans, that DNRC would apply the guidelines in McFadzen (1992) to relevant projects, subject to clarifications about specific issues. (Letter is in the project file).

Although nesting pairs have been documented at the site yearly since 1972, productivity has generally been considered lower than average (McFadzen 1992). The reasons for low productivity are not clear. Hypotheses that cannot currently be rejected include:

- disturbance during critical nesting periods from recreationists, industrial uses, vehicles, or other unknown sources;

- contaminants leading to egg-shell thinning and consequent reproductive failure;

- low productivity of Cyclone Lake food sources (eagles nesting at Cyclone Lake generally "commute" to foraging sites on the North Fork of the Flathead River, which may require energy expenditures that cannot be met with existing supply; Cyclone Lake itself appears not to be a preferred foraging site); and

- limited availability or reduction (through timber harvesting) of preferred nesting, perching, or roosting habitat.

Continued surveys up through at least 1996 verify that nesting and production of nestlings has continued yearly (data courtesy of R. Hickle, FNF. However, these surveys appear insufficient to confirm whether the rate of fledging young continues to be low or has increased.

Since the 1992 report was completed, there have been no substantial habitat alterations in the vicinity of the Cyclone Lake nest. A concern, not documented in the 1992 plan, of increased late winter/early spring snowmobile use of Cyclone Lake has recently been expressed by the public. It is currently unknown what effect this may be having on nesting eagles, although given their history of low productivity and the general pattern of eagle sensitivity to early nesting disturbance, it is a concern.

WOLF (*Canis lupus*)

The project area is within the Northwest Montana Wolf Recovery Area. In the mid-1980's, wolves from British Columbia naturally recolonized the Montana portion of the North Fork. Wolves have maintained a continual presence in the North Fork since that time and litters have been produced there every year since 1986. During the 1990s, wolves expanded the frequency of their use of the North Fork west of Glacier National Park, including the Coal Creek State Forest. Numerous wolf dens have been documented over the past 10 years within 4 miles of the project area, including a litter born in 1997 on nearby USFS land. The North Fork is perhaps the least threatening social environment for wolves in Montana (no wolf-control activities have taken place there since their documented arrival in November 1985) and it continues to be a source of dispersers for the rest of the Northwest Montana Wolf Recovery Area. It also provides demographic and genetic continuity between the Central Idaho and Greater Yellowstone Recovery Areas and Canadian wolf populations to the north.

Dens and early rendezvous sites are usually in relatively low elevation, flat, riparian-associated habitats, within or near winter ranges. These habitats occur in the project area, primarily along Coal Creek, Cyclone Creek, and along the North Fork of the Flathead River. Late summer and autumn habitat use is more dispersed. Habitat management for wolves primarily involves maintenance of their big-game prey base, overall security (mainly by minimizing motorized access and controlling trapping), and site-specific protection of den and rendezvous sites.

GRIZZLY BEAR (*Ursus arctos*)

The Coal Creek State Forest is within the Northern Continental Divide Ecosystem (NCDE) grizzly bear recovery area (USFWS 1993). The NCDE is divided into 23 Bear Management Units (BMUs); each BMU is further divided into subunits, approximately 50 square miles in area. Subunits define the area in which the existing environment and effects of proposed actions are evaluated (USFWS 1995). The grizzly bear analysis area containing the majority of lands affected by this project is the 'State Coal Cyclone' BMU subunit (Figure III-9). The State Coal Cyclone Subunit encompasses 31,316 acres (48.9 square miles). DNRC administers about 43% of the subunit; the FNF administers most of the remainder. An additional 1,896 acres (3 square miles) of DNRC land lies in other BMU subunits.

Guidelines for analyses follow DNRC Interim Guidance for Grizzly Bears (DNRC 1995), which were developed pursuant to direction from the Interagency Grizzly Bear Committee's NCDE Motorized Access Task Group (IGBC 1995). Attributes of the subunit used to describe the existing environment for grizzly bear habitat and the effects of proposed alternatives include measures of motorized access, security habitat, and hiding cover. In addition, we assessed the habitat quality within a 500-meter buffer from all roads within Coal Creek State Forest (see Appendix C, Habitat Values for Grizzly Bears Near Roads), and compared the existing condition with that under the various alternative open- road scenarios associated with each alternative.

Motorized Access:

Motorized access has been shown to be an important factor affecting the effectiveness of grizzly

Figure III-9
Cyclone/Coal Timber Harvest Project
State Coal Cyclone BMU Subunit

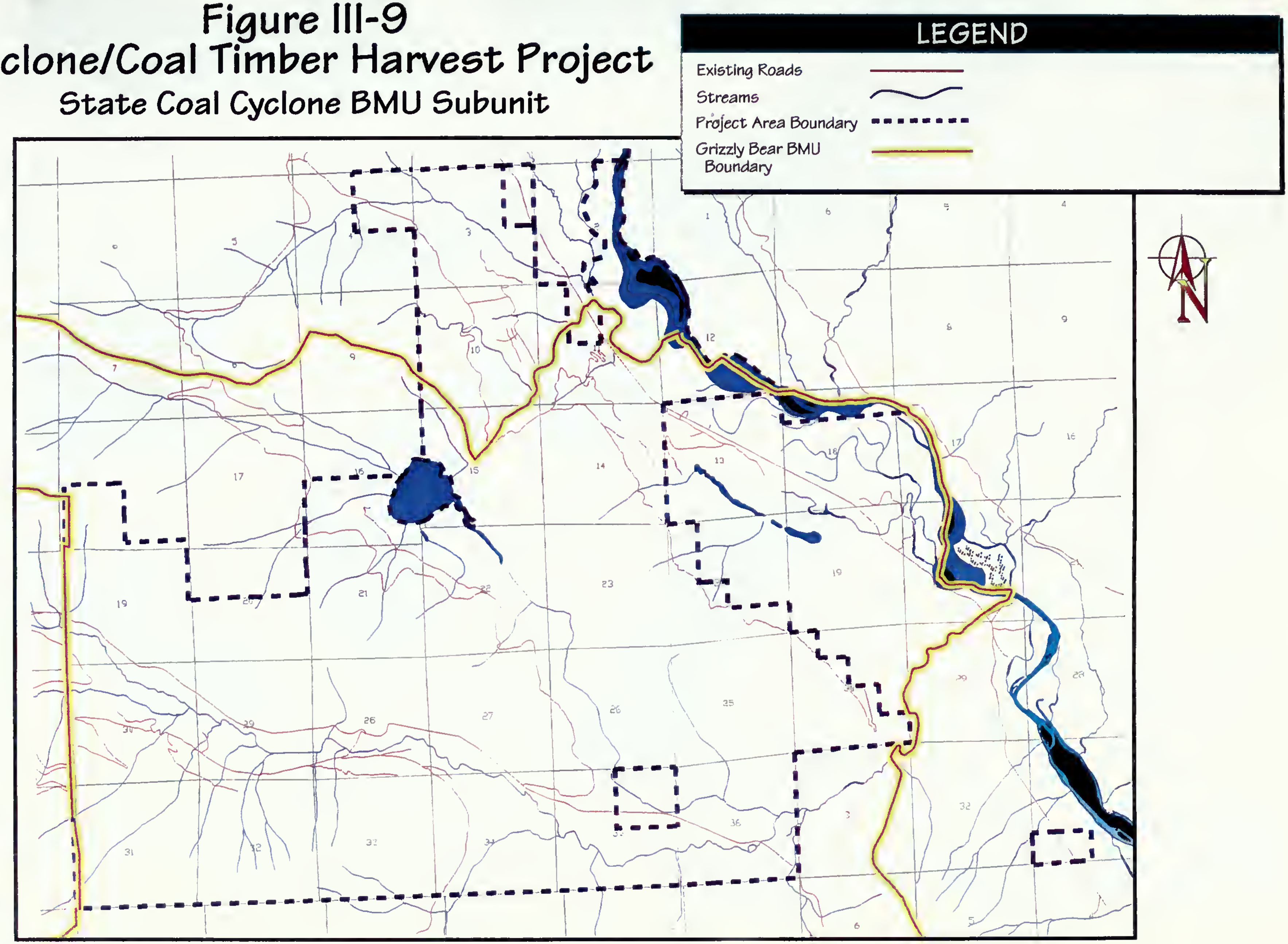
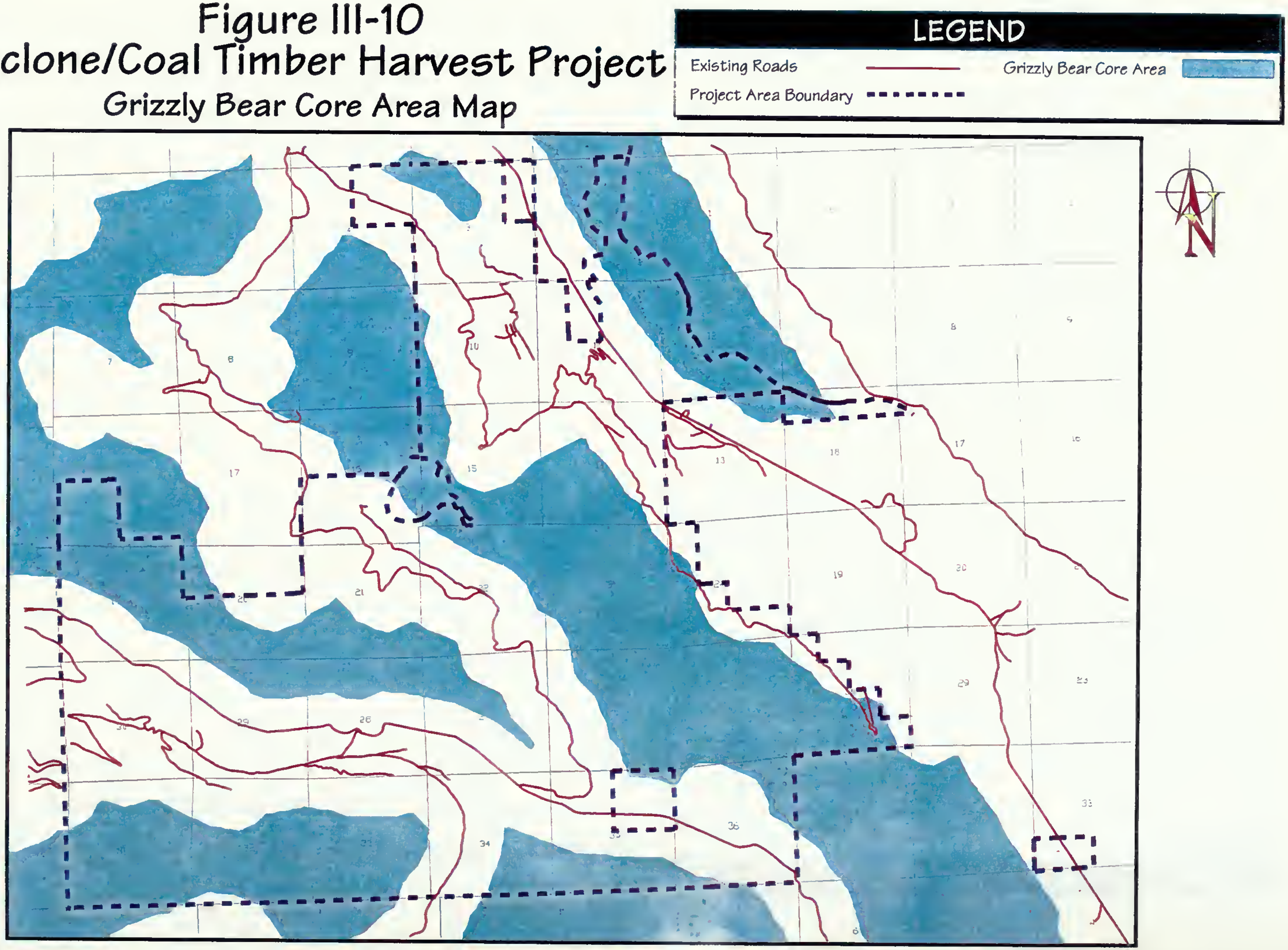


Figure III-10
Cyclone/Coal Timber Harvest Project
Grizzly Bear Core Area Map



bear habitat. Increased motorized access may facilitate increased human-caused bear mortality, displacement of bears from energetically important habitats, and habituation of bears which often leads to bears either being killed or removed to captivity (IGBC 1994).

The effects of motorized access are assessed by a computer-based technique called a "moving-windows" analysis. For the moving-windows analyses in this project, the analysis area is divided into squares (the 'windows') which are 30 meters (about 98 feet) on each side. For each 'window' in the analysis area, the computer calculates how many miles of road exist in the surrounding 1 square mile area. We conducted 2 separate moving-window analyses for the analysis area - the first measuring the influence of *open roads* in the project area, the second measuring the influence of the *total roads* in the project area.

Open roads are defined as those roads that are open for public or administrative motorized use during the period when bears are most likely to *not* be denning, March 16 - November 15. These are the only roads included in the open-road analysis. The percentage of all the 'windows' in the analysis area that have more than 1 mile of open road in the surrounding 1-square-mile area is presently the accepted method to quantify open roads in the NCDE (IGBC 1994, USFWS 1995) and is referred to in this analysis as the Percent Open Road (POR). Currently, 34.6% of the State Coal Cyclone BMU subunit has an open-road density greater than 1 mile per square mile. Considering only DNRC lands within this subunit, some 45.1% contains open-road densities more than 1 mile per square mile. Of total DNRC-controlled lands within Coal Creek State Forest, some 40.8% has open-road densities this high.

The percentage of all the 'windows' in the analysis area that have more than two miles of total road in the surrounding one square mile area is referred to here as the Percent Total Road (PTR). Roads used in the measure of PTR include the open roads in and around the analysis area plus roads that are physically barricaded and receive, at most, low levels of administrative use during 16 through November 15. Roads that are reasonably impassable to motorized vehicles, including off-road vehicles, are not included in PTR calculations. Currently, 30.0% of the State Coal Cyclone BMU subunit has a total road density greater than 2 miles per square mile. Considering only DNRC lands within this subunit, some 35.2% contains open road densities more than 2 miles per square mile. Of total DNRC-controlled lands within Coal Creek State Forest, some 35.7% have open-road densities this high.

Security habitats (sometimes referred to as 'core area') are free of motorized access at least during the March 16 through November 15 period. To be categorized as "security habitats", they must be at least 0.3 miles from a motorized access route (i.e., the roads included in the PTR analysis). (Federal agencies also require that patches categorized as "security" be at least 2,500 acres in size; because DNRC guidance calls for maintaining currently existing amounts of "security habitats" rather than achieving any specified target, this minimum size is not used.) Currently, some 5,894 acres (38.3% of all DNRC controlled lands) qualify as security habitat (Figure III-10 - Grizzly Bear Core Area Map).

Hiding Cover:

Hiding cover is defined as a vegetation patch having a minimum diameter of at least 3 site distances (the distance at which 90% of a grizzly bear is hidden from view), but not less than 300 feet. DNRC Interim Grizzly Bear Guidance (1995) recommends maintenance of at least 40% hiding cover on DNRC land within a BMU subunit. An estimate from our SLI screens (database program available in the Project File) is that 80% of the State Coal Cyclone BMU subunit currently provides hiding cover.

SENSITIVE SPECIES: NOT ASSESSED IN DETAIL

Sensitive species include those in which further population declines may warrant they be listed as threatened or endangered or whose habitats may be particularly sensitive to disturbance by land-management activities. DNRC maintains a sensitive species list for each of its 'areas'.

For the NWLO area, the following species are listed as sensitive, but neither they nor their habitats occur in the Coal Creek project area; and they are excluded from further analyses. A brief rationale explains the basis for not considering these species further in this document.

COEUR D'ALENE SALAMANDER (*Plethodon idahoensis*)

These small terrestrial salamanders are found below 5,000 feet in elevation, primarily in spring seeps, waterfall spray zones, and streamsides of small cascading creeks with dense overhead canopies to maintain cool, moist microclimates. Fractured bedrock or gravels that provide underground refuge during the winter appear to be an important habitat component (Blaustein et al. 1995). Spring seeps underneath an old stand are found in Section 30, T34N, R21W; however, there are no associated rock outcrops, a habitat feature which has been found at nearly all documented sites for this species (Reichel and Flath 1995).

No surveys for this species have been conducted on Coal Creek State Forest. However, surveys on FNF have failed to document Coeur d'Alene salamanders (N. Warren, pers. comm.). At present, its known geographic range does not extend as far east as Coal Creek State Forest (Thompson 1982, Reichel and Flath 1995).

FERRUGINOUS HAWK (*Buteo regalis*)

This large hawk occupies open country, primarily prairies, plains and badlands, sagebrush, saltbush-greasewood shrubland, and the periphery of pinyon-juniper and other woodland types. Such habitats do not occur in the project area.

COLUMBIAN SHARP-TAILED GROUSE (*Tympanuchus phasianellus columbianus*)

This subspecies of the more common sharp-tailed grouse occupies open grassland and shrubland habitats not found in the project area.

FLAMMULATED OWL (*Otus flammeolus*)

These owls are most often found in relatively hot and dry, mature, ponderosa pine/Douglas-fir habitat types with grass- and forb-dominated understories. These types of habitats are not found in the project area.

TOWNSEND'S BIG-EARED BAT (*Plecotus townsendii*)

Townsend's big-eared bat is a widely distributed species that evidently exists in low densities wherever it is found. It appears to be sensitive to disturbance and has a low intrinsic rate of increase, making population recovery following reduction slow and difficult.

In western Montana, Townsend's big-eared bats are most closely associated with cavernous habitat and rocky outcrops of sedimentary or limestone origin, which are used for roosting. In old-growth forests, large-diameter hollow trees may be used for roosting. Maternity colonies are found in warm areas of caves, mines, and, occasionally, buildings. Hibernacula are typically found in caves or mines with winter temperatures 2 to 7 degrees centigrade and a relative humidity of more than 50%.

There are no documented records of this bat from the project area per se, and no caves or abandoned mine tunnels to serve as hibernating sites are known to be in or near Coal Creek State Forest. However, Thompson (1982) indicates a verified specimen taken from the general area.

Townsend's big-eared bats are very susceptible to disturbance and may permanently abandon hibernating sites and roosts if disturbed. Mitigation measures include deferring activities near any such sites discovered and avoiding disturbance. However, we doubt that any such concentration sites exist within the project area.

Townsend's big-eared bats also occasionally use large snags for roosting. All action alternatives call for the retention of large snags; thus long-term habitat capability for this species should not be substantially altered.

Identification of bats to species in the field is difficult; therefore, we are not certain that Townsend's big-eared bats do not inhabit the project area. To further assist in the conservation of this species, contracts written under any action alternative will specify that if any large aggregation of bats is discovered during preparation or administration of the sale, the DNRC Forest Management Bureau wildlife biologist will be informed as soon as possible. Depending on the nature of the report, the biologist will then coordinate efforts to determine the species. If Townsend's big-eared bats are determined to be present, further mitigative measures will be developed as appropriate.

SENSITIVE SPECIES: CONSIDERED THROUGHOUT THE ANALYSIS

The following sensitive species are considered to either occur on or near Coal Creek State Forest or have habitats that are represented within Coal Creek State Forest. They are thus considered throughout the document.

COMMON LOON (*Gavia immer*)

Loons are large, heavy-bodied migratory birds that are entirely water dependent. Because of their large size, they require lakes larger than about 10 ha (approximately 24.7 acres) in size (Skaar 1989). In Montana (the southern end of their breeding range), loons usually arrive from their wintering grounds along the Pacific coast in April, so lakes that are still frozen are unavailable for nesting. Nest building and incubation normally occur in May and the chicks usually hatch in early June. Nesting loons are sensitive to disturbance (primarily boaters) and will leave a nest if they feel threatened, exposing the chicks to predators and weather (Dolan 1994).

Nesting loons have been documented on Cyclone Lake since 1982 and appear to have enjoyed approximately average nest success rates for Montana (Dolan 1994). Although loons are primarily sensitive to disturbance from open water, they can also be disturbed from the shoreline near nesting and nursery areas.

HARLEQUIN DUCK (*Histrionicus histrionicus*)

The harlequin duck is a relatively rare species that is considered sensitive to human disturbance and habitat modification. They breed in swift, clean, clear streams with cobble-to-boulder substrate and winter on the Pacific Ocean.

Harlequin ducks have not been documented from Coal Creek State Forest, but are known to nest in the adjacent FNF, Glacier National Park, and Stillwater State Forest. Recently, there has been an increased concern about harlequin ducks because of an apparent population decline in Glacier National Park.

BOREAL OWL (*Aeglius funereus*)

Boreal owls inhabit mature to old-growth coniferous forests at higher elevations. Cool, moist habitat types dominated by spruce and fir are most commonly used, but use of western hemlock and Douglas-fir habitat types has also been documented in Montana and Idaho (Hayward et al. 1993). Boreal owls are predominantly found above 5,000 feet elevation in Montana, but use of cool, moist microsites down to 4,200 feet has been observed (Hayward and Verner 1994). Like the flammulated owl, boreal owls are a cavity-dependent species that rely upon other species (primarily pileated woodpeckers and flickers) to excavate the cavities they use. Different forest structures are used for nesting (more vertical diversity) versus foraging and roosting (more open understories). These different forest types need not be adjacent because boreal owls will fly several miles between disjunct patches of suitable habitats to meet various life-history requisites.

Boreal owls are believed to inhabit Coal Creek State Forest.

BLACK-BACKED WOODPECKER (*Picoides arcticus*)

Black-backed woodpeckers are predominantly found in standing dead forests created by stand-replacement fires (Hutto 1995). Although such a cover type does not currently exist on the project area, portions of the project area represent potential habitat for this species because many stands are characterized by high-severity, stand-replacement fires. Additional foraging and nesting habitats for black-backed woodpeckers are also in older lodgepole pine forests with high densities of bark beetles and heartrot (Goggans et al. 1989).

PILEATED WOODPECKER (*Dryocopus pileatus*)

Pileated woodpeckers require large, heart-rotted trees for nesting (preferably larch, ponderosa pine, and cottonwood) and rotted, coarse woody material (from a variety of species) for foraging. These features are usually associated with older, mature forests. Because of their large size, nest trees for pileated woodpeckers are usually at least 20 inches dbh. Cavities excavated by pileated woodpeckers are used in subsequent years by many other species that require tree cavities but do not excavate their own. Pileated woodpecker territories are known to exist within Coal Creek State Forest (R. McClelland, pers. comm., 1997).

NORTHERN BOG LEMMING (*Synaptomys borealis*)

Bog lemmings in Montana are closely associated with the presence of large, thick moss mats, particularly sphagnum moss (Reichel and Beckstrom 1994). A few, small populations have also been found in other mesic sites with sedge or brush vegetation.

Northern bog lemmings have not been documented from the project area per se; however, populations are known from nearby Glacier National Park.

Management recommendations that have been promulgated by the Montana Natural Heritage Program and included within DNRC guidance include:

- maintaining a 100-meter buffer for management activities around riparian areas/corridors where sphagnum mats are found,
- minimizing domestic livestock grazing in drainages with sphagnum mats present and maintaining good-to-excellent range conditions in these riparian areas, and
- avoiding human activities that will alter streamflow in drainages with sphagnum mats present.

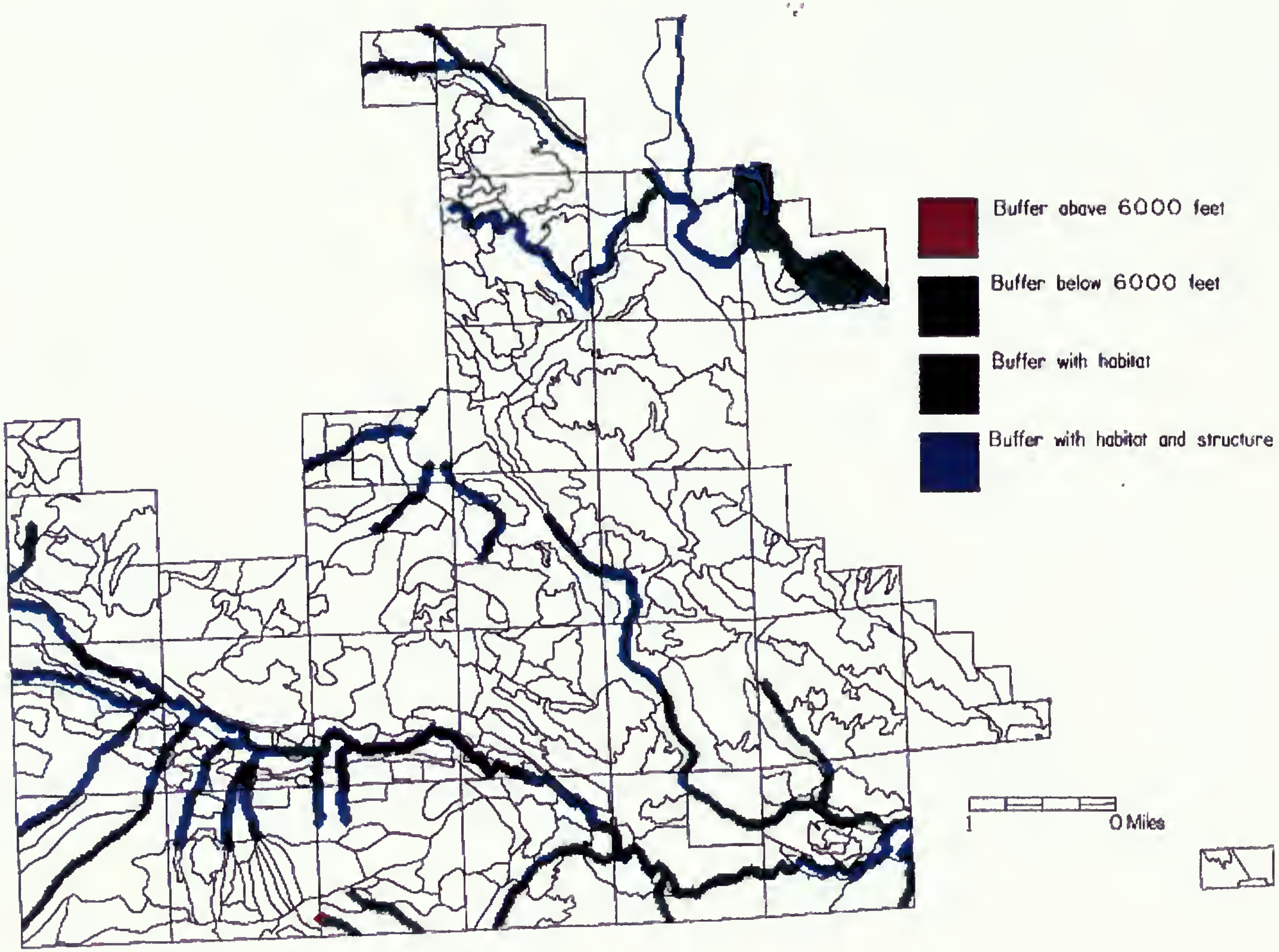
FISHER (*Martes pennanti*)

The fisher is a medium-sized member of the weasel family (Mustelidae), closely associated with forested habitats. In the western U.S., it is generally associated with closed-canopy forests where snow depths are moderated. Because of its body shape and energetic demands, the fisher cannot easily cope with deep snow conditions. Fishers will use a variety of forest conditions, but often travel and hunt near riparian zones and rest in snags, down logs, witches-brooms, or other structures associated with older forests. They prey principally on a variety of small mammals, including voles, squirrels, snowshoe hares, and porcupines.

Fishers typically have large home ranges and can be negatively affected at a population level by excessive fragmentation of acceptable habitat. Thus, assessing habitat features on a small scale (e.g., stand level) is of limited use; instead, landscape scale assessments (e.g., on a scale of the entire Coal Creek State Forest) are more meaningful. One coarse habitat feature usually associated with fishers, the mature forest, appears to be common currently on Coal Creek State Forest. More specifically, we looked at 2 habitat components that can be quantified at a landscape scale, to assess current fisher habitat and see how it might be altered with timber harvesting:

- canopy density (assumed to be a reasonable surrogate for forest structure near the ground) within buffers of 50 meters on either side of all perennial streams within Coal Creek State Forest, as quantified by the Stand-Level Inventory; and

Figure III-11 Fisher Map



- connectivity among adjacent drainages, defined again as a minimum acceptable canopy density.

The first analysis assumes that fishers preferentially use riparian zones (and/or habitats near them), and within these, prefer those with a substantial overstory structure which evidently provides for both prey availability and resting sites (Powell and Zielinski 1994, Buskirk and Powell 1994). As well, this analysis asks whether important riparian buffers are so lacking in overhead cover that they may act as barriers to fisher movement.

The second analysis concerns itself with connectivity among low-elevation drainages: although relatively low-elevation riparian zones are evidently preferred, individual fishers likely use more than 1 fourth-order, or even third-order, drainage, and so require that there be acceptable travel habitat between streams. This analysis asks whether natural features and/or timber harvesting have fragmented the landscape to the point where, although individual riparian zones may possess high-quality fisher habitat, the entire landscape no longer contains sufficient connectivity to allow for functional home ranges.

Structure within appropriate riparian habitat

We buffered all riparian zones less than 6,000 feet in elevation (fishers rarely hunt or rest in higher elevations), excluding cover types that rarely contain complex structures near the ground (Douglas-fir and lodgepole pine-dominated sites). Within all these acres, we tallied those in which stands were classified as "sawtimber" (dominated by 9"+ trees) and in which stocking was characterized as "well-stocked" overall, or at least "moderately stocked" in the overstory component. Approximately 729 of 1066 acres of potential riparian buffer (68.4%) had the requisite stocking assumed to provide for fisher foraging and resting (Fig. III-11).

Guidance for meeting our SFLMP standard for sensitive species suggests that this proportion should be no less than 75%; thus, it would appear initially that Coal Creek State Forest fails to meet our suggested target. However, there are good reasons to suspect that the 68.4% figure constitutes an underestimate:

- Stocking levels are calculated from standwide averages, and these stands usually include areas far from the stream itself. Most often, stocking density increases closer to streams, so that had stocking densities been estimated from within the 50-meter buffer only, they likely would often have been higher;

- Figure III-11 suggests that many stream reaches where threshold stocking is absent are places where natural features (e.g., avalanche chutes south of Coal Creek), rather than a history of timber harvesting, are the cause, and many of these area may still provide acceptable fisher habitat because of structure in the form of large, dense, woody shrubs;

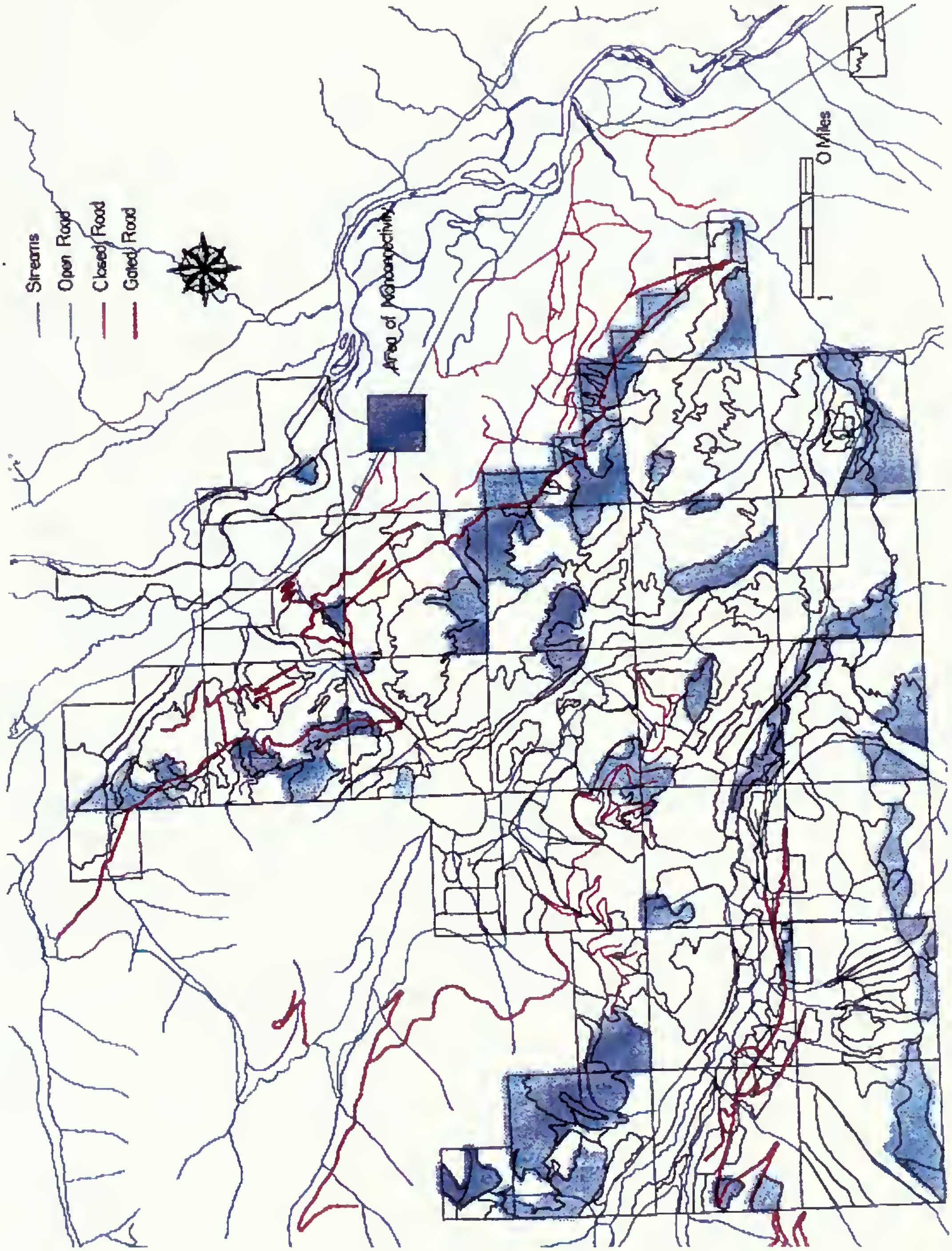
- Figure III-11 shows that a majority of the major third-order drainages within Coal Creek State Forest (Coal Creek, Cyclone Creek, and Dead Horse Creek), which likely provide important foraging and movement routes for fishers, retains uninterrupted cover, and

- An additional likely region of foraging and movement for fishers is the "saddle" between Winona Ridge and Winona Peak (i.e., northeast of Cyclone Lake), which does not qualify as "riparian" in this analysis and is characterized by dense cover.

CONNECTIVITY AMONG ADJACENT DRAINAGES

To assess connectivity, we produced a map showing all patches in which forest stocking was poor or lacking entirely. These patches were then buffered by 50 meters on each boundary; any mapped patch therefore represented a relatively open area of at least 100-meter width in its narrowest point. These patches model movement barriers to fishers. We then assessed the spatial location of these movement barriers with respect to third-order drainages, as well as stands that contain potential

Figure III-12 Lynx/Fisher Connectivity Map



foraging habitat. The resultant map (Figure III-12) suggests that, although patches that would not be acceptable travel habitat currently exist, none produce insurmountable barriers between adjacent third-order drainages.

LYNX (*Lynx canadensis*)

The lynx is currently a candidate species for listing under the U.S. Endangered Species Act. As of this writing (1998), it is widely expected that lynx will be listed as either threatened or endangered in Montana during 1999.

Throughout North America, lynx distribution and numbers are strongly correlated with their primary prey, snowshoe hares. At the lower latitudes of lynx distribution, lynx are found at higher elevations where environmental conditions are more similar to the boreal forests of Canada and Alaska. Within these forests, lynx habitat in western Montana appears to consist of a heterogeneous mosaic of two structurally different forest cover types: early to early/mid-successional coniferous forests that contain high numbers of snowshoe hares for foraging, and late successional forests with large amounts of downed woody debris to provide thermal and security cover for kittens (Koehler and Aubry 1994). We currently lack a thorough understanding of what types and conditions of forests in western Montana provide optimum, or even acceptable, amounts of these two habitat elements, but it does seem clear that elements of both are needed for hares and lynx (Quade 1996). A third component that appears necessary is a minimum amount of forest cover on lands that serve to connect the first two.

We currently lack specific information on the quality of lynx habitat within Coal Creek State Forest. It is likely that lynx use all or portions of Coal Creek State Forest. Patches that contain older forest structures with potential lynx denning habitat are relatively common in Coal Creek State Forest, especially on north and flat aspects in the northern portions of Coal Creek State Forest (e.g., Sections 3, 10), around Cyclone Lake, and south of Coal Creek (e.g., Sections 31, 32, and 33). Patches of early successional forest have been created by previous timber harvesting in Cyclone basin and south of Coal Creek, often in close proximity to older forest. Regeneration in most of these younger forests is primarily western larch and Englemann spruce and remains predominately unthinned. The most recent natural disturbances that could produce young stands (fires on the northern aspect of Winona Ridge and south of Coal Creek) are now at least 40 years in the past. Young lodgepole pine stands are frequently cited as capable of supporting high densities of snowshoe hares, particularly during especially harsh winters (Koehler and Aubry 1994), but these stands are currently rare on Coal Creek State Forest. The preponderance of existing lodgepole stands are older and of larger diameter than is considered optimal for hares (Koehler and Brittel 1990).

Forest stands harvested during the past 10-20 years probably constitute travel barriers for lynx; however, their current juxtaposition would not appear to preclude lynx from gaining access to existing old and young stands on Coal Creek State Forest and neighboring Federal lands. (Fig. III-12).

BIG GAME SPECIES

ELK (Cervus elaphus)

Elk are present, although probably not abundant, on the Coal Creek State Forest. During summer, we presume that they range widely, and often to higher elevations in the Whitefish and/or Livingston ranges. During winter, they evidently prefer lower elevations along the North Fork of the Flathead River, Coal Creek, and southwestern aspects on Winona Ridge (See Figure III-13).

MULE DEER (Odocoileus hemionus)

Mule deer are present and widely distributed during summer on Coal Creek State Forest. Mule deer winter range is restricted to the southwestern slopes of Winona Ridge on Coal Creek State Forest, as well as the flats of the North Fork of the Flathead River, directly east of Coal Creek State Forest (Figure III-14).

Figure III-13
Cyclone/Coal Timber Harvest Project
Elk Winter-Range Map

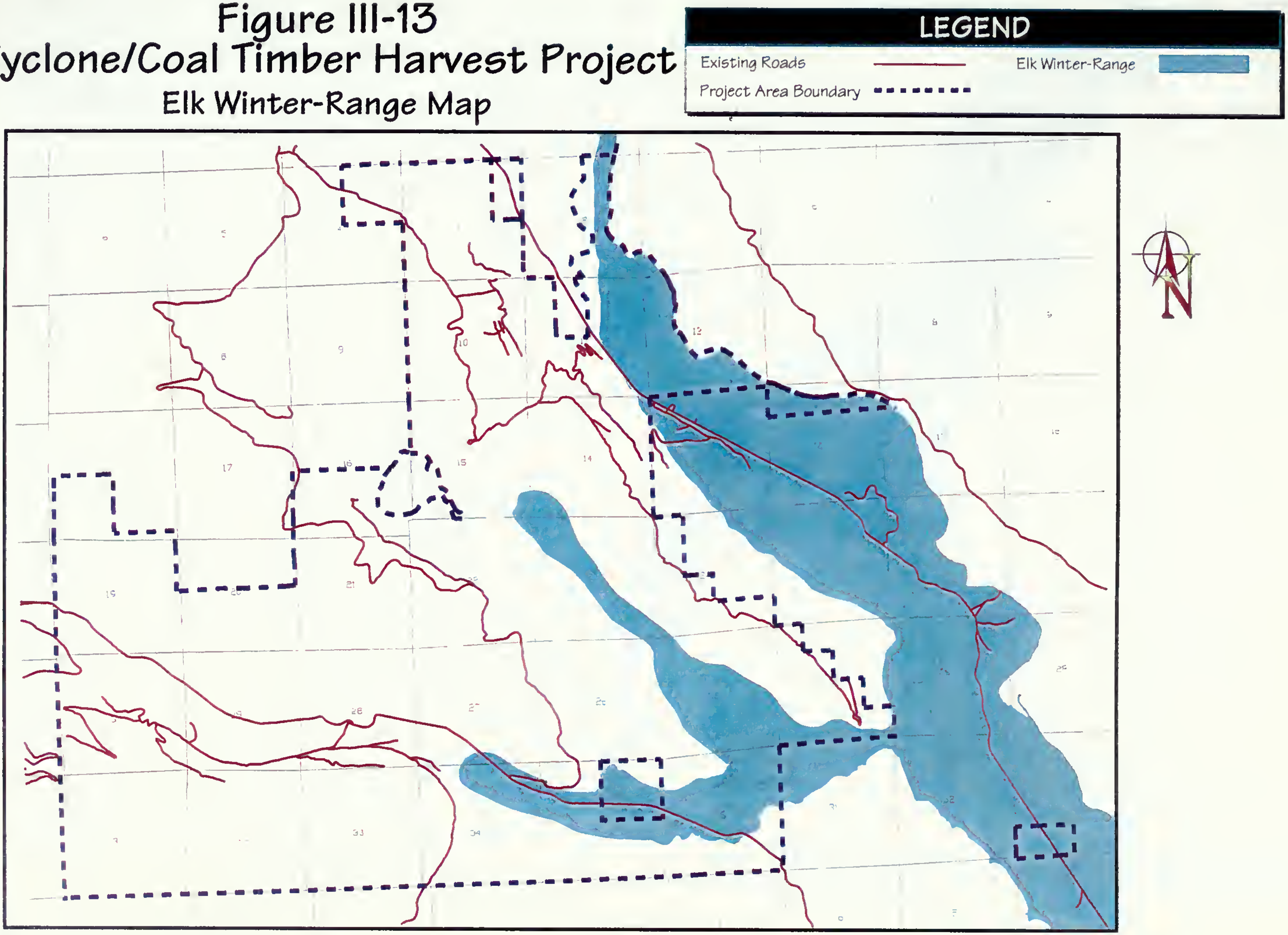


Figure III-15
Cyclone/Coal Timber Harvest Project
White-tailed Deer Winter-Range Map

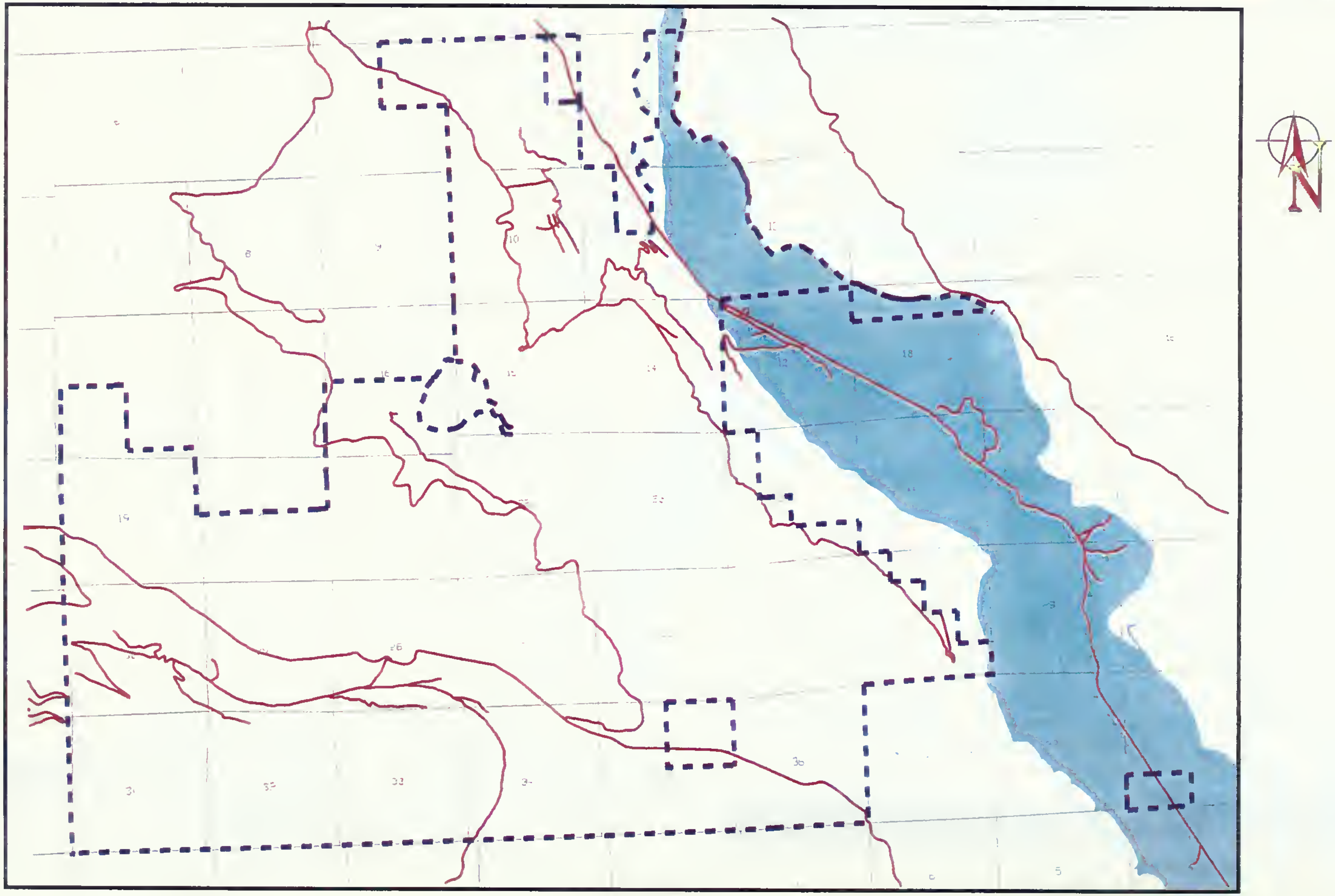


Figure III-15
Cyclone/Coal Timber Harvest Project
White-tailed Deer Winter-Range Map

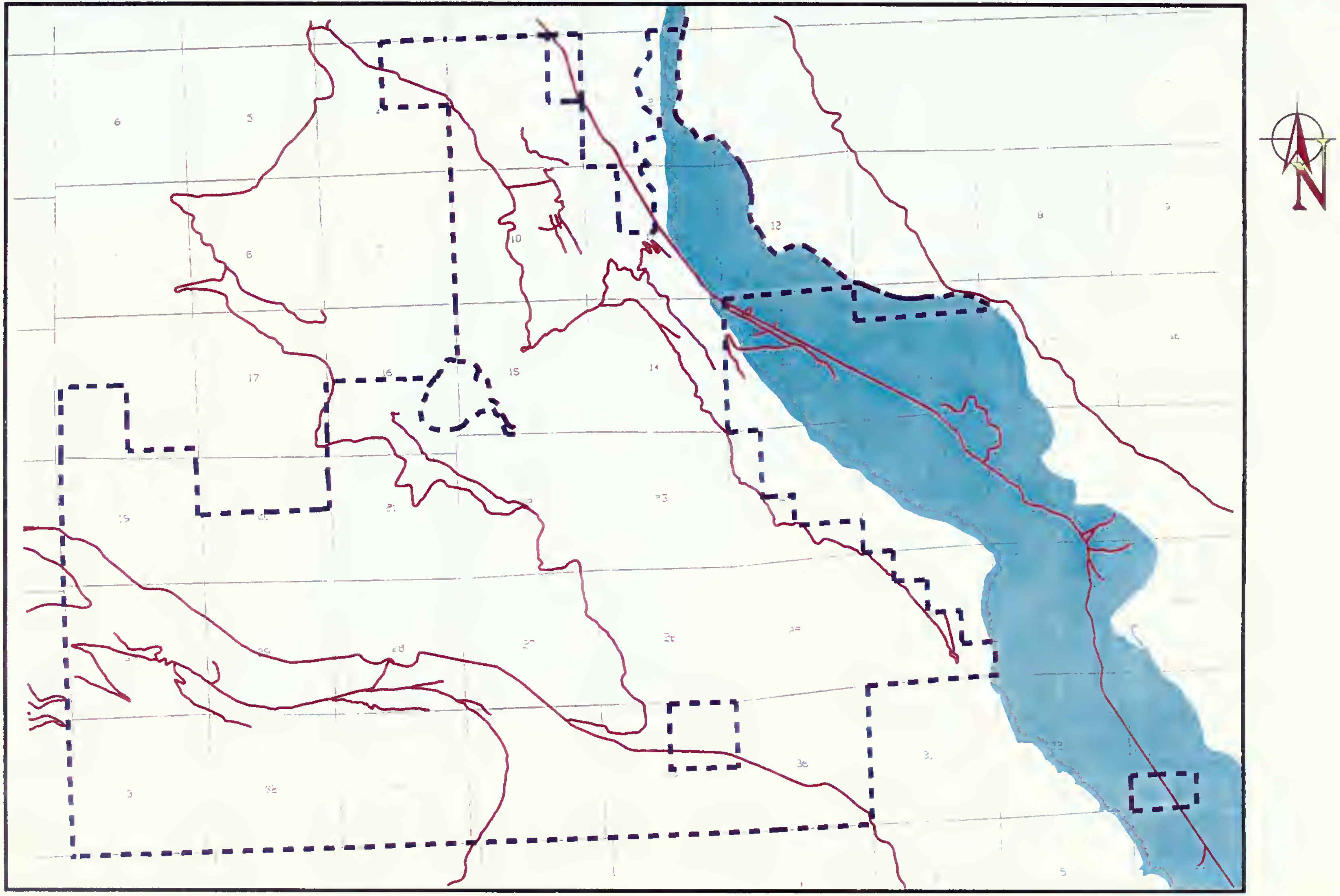
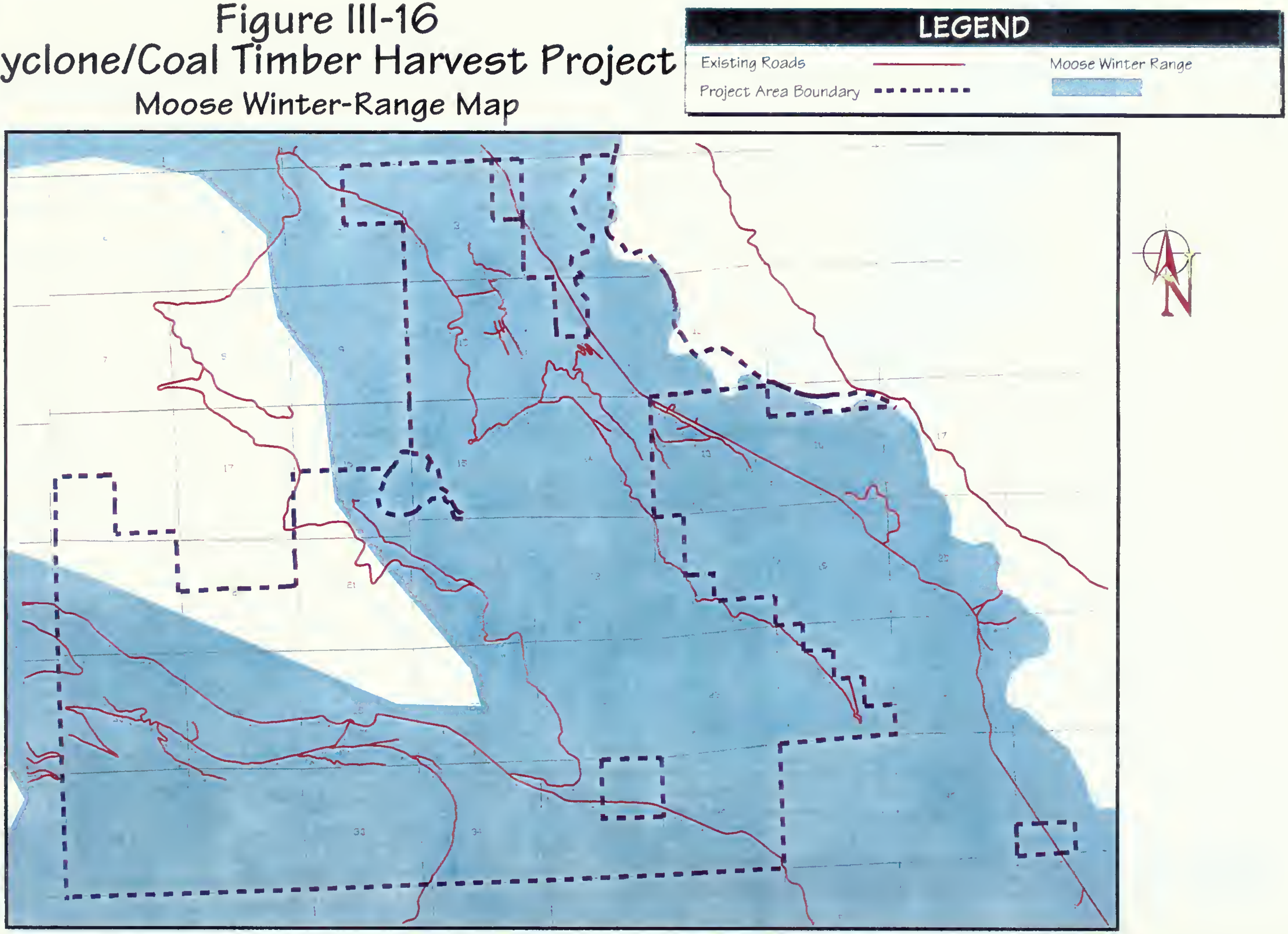


Figure III-16
Cyclone/Coal Timber Harvest Project
Moose Winter-Range Map



WHITE-TAILED DEER (O. virginianus)

White-tailed deer are present and widely distributed during summer on Coal Creek State Forest. White-tailed deer exploit a wide variety of habitats during summer, but are closely associated with closed-canopy forest during winter (especially when snow depths are high, as during the 1996-97 winter). Removal of forest canopy that produces effective snow interception is, thus, generally detrimental to white-tailed deer when it occurs on areas used by them during winter. White-tailed deer are also among the most abundant and vulnerable prey items for recolonizing wolves in the North Fork of the Flathead River valley. Winter range for white-tails appears limited to the flats of the North Fork of the Flathead River, primarily east of Coal Creek State Forest (Figure III-15).

MOOSE (*Alces alces*)

Moose are widely and sparsely distributed throughout Coal Creek State Forest during summer. Unlike the other 3 Cervid species considered here, moose in winter do not congregate into relatively restricted and predictable areas. Rather, moose winter singly or in small family units throughout Coal Creek State Forest, using relatively small areas to conserve energy. Moose winter range evidently covers the entire Coal Creek State Forest, with the exception only of Coal Ridge (Figure III-16). Like the other 3 species, moose are generally adapted to a variety of seral stages, using forage that is usually most abundant and palatable following disturbance, but using closed-canopy forests for snow-intercept (and possibly also for thermal cover) during winter. Unlike the other species, however, moose are adapted to relatively deep snow during winter, and, at least in this area, do not migrate to lower elevations areas where snow is more shallow.

WATERSHED

The sale area is drained primarily by Coal Creek, a 52,477-acre, fourth-order perennial tributary to the North Fork of the Flathead River. The eastern portion of the proposed project area is drained by several first- and second-order watersheds, which are tributary to the North Fork of the Flathead River. These small watersheds are intermittent, losing evidence of a scoured channel once they reach the valley bottom, and transfer surface runoff to the North Fork only during extreme runoff events. The State of Montana owns approximately 18 square miles in the Coal Creek watershed, small portions are owned privately, and the remainder is owned by USFS. Precipitation in and around the proposed sale area ranges from 30 inches annually in the North Fork of the Flathead River valley to 70+ inches in the higher elevations.

WATER QUALITY

Timber harvesting and related activities, such as road construction, can lead to water-quality impacts by increasing the production and delivery of fine sediments to streams. Construction of roads, skid trails, and landings can generate and transfer substantial amounts of sediment through the removal of vegetation and exposure of bare soil. In addition, removal of vegetation near stream channels reduces the sediment-filtering capacity and may reduce channel stability and the amounts of large woody material. Large woody debris is a very important component of stream dynamics, creating natural sediment traps and energy dissipators to reduce the velocity and erosiveness of stream flows.

REGULATORY FRAMEWORK

SURFACE WATER QUALITY STANDARDS

This portion of the Flathead River drainage, including Coal and Cyclone creeks and all of their tributaries, is classified B-1 by the Montana Surface Water Quality Standards. Among other criteria for B-1 waters, no increases are allowed above naturally occurring levels of sediment; minimal increases over natural turbidity are allowed. Naturally occurring includes conditions or materials present from runoff on developed land where all reasonable land, soil, and water conservation practices (commonly called BMPs) have been applied. Reasonable practices include methods, measures, or practices that protect present and reasonably anticipated beneficial uses. These practices include, but are not limited to, structural and nonstructural controls and operation and maintenance procedures. Appropriate practices would be applied before, during, and after all proposed management activities.

Water-Quality-Limited Waterbodies

The main stem of Coal Creek is named on the 1996 list of water-quality-limited streams by the Montana Department of Environmental Quality (DEQ). The listed impairment is siltation; the probable source of impairment is listed as silviculture. Waterbodies listed as water-quality limited are prioritized by the DEQ for development of a total maximum daily load (TMDL). Coal Creek is not listed in the top 10 waterbodies for TMDL development. Until a TMDL is developed for a listed waterbody, House Bill 546 (Montana TMDL Law) states that new or expanded activities which may further the listed impairment may commence and continue provided they are conducted using all reasonable land, soil and water conservation practices (commonly called BMPs).

CURRENT WATER-QUALITY CONDITIONS

The primary impacts to water quality in the proposed project area are related to the existing road system. Moderate- to low-standard roads have been constructed by FNF and DNRC to access past logging units throughout the Coal Creek watershed. Most of the road system is in need of erosion-control measures to meet current BMP standards. The roads are constructed on moderate grades in most cases, and very few are located in wet areas or adjacent to streams. There are some surface-drainage features installed on all of the roads in the proposed project area, but, in most cases, features are constructed too far apart to be effective, and many need to be reconstructed to current specifications.

Several existing or potential point sources of sediment are found in and around the proposed project area:

- One is located in Section 28, T34N, R21W, on the Deadhorse Bridge that crosses the main stem of Coal Creek. The approaches on both sides of the bridge deliver surface runoff from the road directly to Coal creek. The bridge is not properly sized for the creek and has been over-topped numerous times during spring runoff. Nor is it long enough for the site, creating a constriction of the stream channel. The bridge poses a moderate-to-high risk of failure since it has been weakened by years of erosion and flooding.

- Another sediment source is located in Section 30, T34N, R21W, near a switchback on an existing road. A slope failure, approximately 50 feet wide at its base and 150 to 200 feet long, has occurred in the last 5 to 10 years. The debris flow, which resulted from this landslide, was deposited into a steep, high-gradient, first-order tributary to the South Fork of Coal Creek. The slide occurred in material prone to this type of failure, but the poor road surface and ditch drainage on the road above the failure likely contributed to its occurrence.

- A third potential source of sediment is located on a road constructed in Section 28, T34N, R21W. In the late 1980s, a portion of the fill slope slumped and partially blocked a small intermittent stream. The site was stabilized with vegetation, and a slash-filter windrow was installed to capture any additional eroded soil. The site appears to have remained stable for the last several years.

  The road system which accesses the east face of Winona Ridge also contains slope failures:

- In Section 11, T34N, R21W, there is a slope failure on a portion of an existing road. This failure does not appear to be related to problems with road maintenance, but solely related to geology on the site. The slope failure is not located near, nor does it affect, a stream or draw.

- On the road system located in Sections 14 and 24, T34N, R21W, there are several places where the cutslope of the road slumps periodically. Some of these slumps have occurred where the road enters a draw. In some cases, this has led to scour of the road surface where ditchwater is directed onto the road due to filling of the ditch.
- Finally, there is a cutslope failure on an existing road located in Section 10, T34N, R21W. This site is not located near a draw or stream and has not delivered sediment to a live stream or draw.

CUMULATIVE WATERSHED EFFECTS OF PAST ACTIVITIES

CURRENT CONDITIONS

Land-use history within the proposed project area includes commercial timber harvesting and recreational activities. This harvesting has occurred on DNRC land, and on adjacent nonindustrial private and FNF land, beginning in the 1950s. The most recent timber harvesting on State land occurred in the late 1980s; FNF last entered the Coal Creek watershed in 1990 and 1991. Timber-harvesting activities have also occurred on the east face of Winona Ridge in the first-order tributaries to the North Fork of the Flathead River. The most recent harvesting of these watersheds took place in the early 1980s. Field review of these intermittent creeks showed no scour or other signs of water yield increases or deposition of sediment as a result of any of these activities.

Cumulative watershed impacts are defined as impacts to water quality that may result from the proposed action when combined with other past and present actions. Individually, these actions may not adversely affect water quality, but present a higher risk of adverse impacts when combined. Timber harvesting and associated activities can affect the timing, distribution, and amount of water yield in a harvested watershed. Water yields increase proportionately to the percentage of canopy removal, because removal of live trees reduces the amount of water transpired, leaving more water available for soil saturation and runoff. Canopy removal also decreases interception of rain and snow and alters snowpack distribution and snowmelt, which lead to further water yield increases. Higher water yields may lead to increases in peak flows and peak-flow duration, which result in accelerated streambank erosion and deposition.

A DNRC hydrologist gathered channel-stability data in the summer of 1997 on the main stem of Coal and on Cyclone creeks above Cyclone Lake. Procedures used are outlined in Forest Hydrology Part II (Haupt 1974). Coal Creek was surveyed at 2 locations; channel stability was rated as fair to good in each reach. Cyclone Creek above Cyclone Lake was rated as having good channel stability. These channel-stability assessments are used to determine the stream's capacity to handle increases in annual runoff in accordance with procedures outlined in Forest Hydrology Part II (Haupt 1974).

DNRC's hydrologist estimated that channel stability and water quality in the Coal Creek watershed, including Cyclone, South Fork of Coal, and Lower Coal creek drainages might begin to be adversely affected if water yield were to increase 10% above the projected baseline. This threshold of concern was arrived at through analysis of the channel-stability assessments and direction from the SFLMP to manage low-risk watershed impacts in Coal Creek State Forest.

METHODOLOGY

The potential watershed cumulative effects of past activities in the Coal Creek watershed were determined using the PC version of the WATSED model developed by Region 1 of the USDA Forest Service. WATSED estimates the increase in water yield caused by removal of live trees using the Equivalent Clearcut Area (ECA) method. ECA is a function of total area roaded and harvested, percent of crown removal in harvest, and amount of vegetative recovery that has occurred in harvest areas. This method equates area harvested and percent of crown removed with an equivalent amount of clearcut area. For example, if 100 acres had 60% of crown removed, ECA would be

TABLE III-18 WATSED PREDICTED WATERSHED EFFECTS FOR CYCLONE, LOWER COAL, AND THE SOUTH FORK OF COAL CREEKS

Watershed	Watershed Acres	Acres of Existing Harvest	Miles of Existing Roads	Existing ECA[1]	Allowable ECA[2]	Existing Water Yield Increase	Allowable Water Yield Increase
Cyclone	8,355	1,383	29.1	491	2,088	3%	10%
Lower Coal	10,663	1,126	20.5	384	2,665	1%	10%
South Coal	11,785	2,379	35.5	615	2,946	3%	10%

[1] ECA estimate includes acreage in roads.
[2] Allowable ECA for each of the watersheds was set based on a 10% allowable increase in water yield (Young 1989). This value is a result of guidelines set down in the SFLMP Record of Decision, which requires a low degree of risk when setting watershed cumulative effects thresholds in the Coal Creek watershed.

approximately 60, or equivalent to a 60-acre clearcut area. As live trees are removed, the water they would have evaporated and transpired either saturates the soil or is translated to runoff. This method also calculates the recovery of these increases as new trees vegetate the site and move toward preharvest water use. WATSED also estimates sediment production from road and timber-harvesting activities. Estimates of sediment production by activities are expressed as a percentage above an estimated "natural" baseline condition generated by the model based on soil types and watershed size. Since the natural conditions are calculated on the basis of empirical formulas and not on site-specific measured data, sediment values generated by the model are only valid as a comparison between alternatives and should not be interpreted as absolute values.

The WATSED model was run on 3 of the 5 subwatersheds in the Coal Creek drainage in order to better analyze the potential effects of the proposal. Analysis of the entire Coal Creek watershed would likely dilute the potential watershed effects, and WATSED results are not designed for watersheds the size of Coal Creek. WATSED was run on the 3 subwatersheds - Cyclone, South Fork of Coal, and Lower Coal creeks - affected by the proposed project.

RESULTS

According to WATSED, none of the 3 watersheds drained by the proposed project area are near the recommended 10% threshold for water yield increases. Table III-18 displays the current conditions for Cyclone, Lower Coal, and the South Fork of Coal creeks.

FISHERIES

Westslope cutthroat trout and bull trout are species of special concern in Montana; they are found in limited numbers and habitats in Montana. The DFWP manages the Coal drainage for the native westslope cutthroat trout and bull trout. In order to meet the recommendations for these species from the Flathead Basin Forest Practices, Water Quality and Fisheries Cooperative Program (the cooperative study report)(Flathead Basin Commission, 1991), DNRC has contracted with DFWP for the collection efforts required to develop index values of existing habitat quality as recommended. The DNRC/DFWP strategy is to first develop the index of juvenile bull trout rearing-habitat quality using substrate scoring. Spawning and incubation habitat quality is also being assessed by McNeil coring, as described in the cooperative study report. Based on the results from these activities, DNRC, in consultation with DFWP, will decide if additional monitoring is necessary.

NORTH FORK OF THE FLATHEAD RIVER

Bull trout and migratory westslope cutthroat trout inhabit Flathead Lake and the North Fork of the Flathead River and use the North Fork of the

Flathead River tributaries for spawning and rearing. Because of this migratory behavior, the effects of the proposed timber harvesting on the Coal Creek watershed and downstream waters must be considered.

The presence of bull trout and cutthroat trout in the North Fork of the Flathead River and Coal Creek indicate that mitigating measures, including the Immediate Actions for Bull Trout Recovery agreed upon by DNRC and the Governor's Bull Trout Restoration Team in 1994 (Montana DNRC 1994), should be implemented on all streams affected by the proposal.

COAL CREEK

In 1979, DFWP began its Coal Creek/Flathead River Basin Monitoring Study to develop baseline data for the Flathead River Basin and its tributaries. One of the tributaries sampled through this effort is Coal Creek. Data were obtained through spawning surveys and McNeil coring; data for the last 4 years are reported in Table III-19.

CYCLONE CREEK

Tom Weaver, a fisheries biologist from DFWP, began gathering baseline data for the Cyclone Creek watershed in July of 1994. Data were obtained through species composition surveys, spawning surveys, and substrate scoring on Cyclone Creek. Evidence of both westslope cutthroat trout and bull trout was found. Spawning surveys, substrate scores, and McNeil core sites have been monitored annually since fiscal year 1995, with the results to date reported in Table III-20.

The Flathead Basin Forest Practice Study showed a direct link between on-the-ground activity (Sequoia Index) and habitat quality (McNeil coring). The study showed an even stronger tie between spawning-habitat quality (percent fines) and embryo survival to emergence. The cooperative recommended caution when the amount of fine material (6.35 millimeter or smaller), as indicated by McNeil coring, exceeded 35%. Recommendations call for a red flag at levels above 40%. The 1997 McNeil coring sample for Cyclone Creek showed the fine material (6.35 millimeter or smaller) at 31.6%. The decreased fines indicated in the table suggest that spawning habitat has improved in recent years.

TABLE III-19 SUMMARY OF FISHERIES MONITORING DATA IN COAL CREEK

Parameter	FY 1995	FY 1996	FY 1997	FY 1998
Bull Trout Redds[1]	6	13	3	5
Substrate Score	10.5 (7/94)	10.8 (7/95)	10.9 (7/96)	10.8 (7/97)
McNeil Core	32.6 (3/95)	37.5 (3/96)	38.2 (3/97)	No Results[2]

[1] Coal Creek is too large to conduct spawning surveys for westslope cutthroat trout since this must be conducted during spring runoff.
[2] Sample was taken 3/98, results not compiled to date.

TABLE III-20 SUMMARY OF FISHERIES MONITORING DATA IN CYCLONE CREEK

Parameter	FY 1995	FY 1996	FY 1997	FY 1998
Bull Trout Redds[1]	6	13	3	5
Substrate Score	10.5 (7/94)	10.8 (7/95)	10.9 (7/96)	10.8 (7/97)
McNeil Core	32.6 (3/95)	37.5 (3/96)	38.2 (3/97)	No Results[2]

[1] Coal Creek is too large to conduct spawning surveys for westslope cutthroat trout since this must be conducted during spring runoff.
[2] Sample was taken 3/98, results not compiled to date.

AIR QUALITY

Federal, State, and local agencies enforce rules for open controlled burning. Air quality is analyzed by estimating emissions from prescribed broadcast burns and determining which roads would have road dust created by project activity vehicles.

The area analyzed for air quality, which includes all of Flathead County, is located in Montana Airshed 2; the project area is approximately 16 air miles north of the Columbia Falls impact zone. Both are delineated by the Montana Airshed Group. The project area is also located approximately 3 air miles west of Glacier National Park, designated as a Class 1 airshed by the Federal Clean Air Act.

Temporary reductions in air quality currently exist from the occurrence of wildfires, prescribed broadcast burning, and road dust.

VISUAL CHARACTERISTICS

METHODOLOGY

The visual characteristics within the Cyclone/Coal project area were assessed using a similar technique to that used by the Forest Service and outlined in Agricultural Handbook 462. In general, we scouted the project area for potential harvest units that were clearly visible from well-traveled roads. We determined that Unit 2 was visible from the North Fork Road, and subsequently described the current conditions of the area, looking at the foreground, middleground, and the background.

CURRENT CONDITIONS

Within the project area, only Unit 2 is visible from portions of the North Fork Road (Route 486) and Glacier Route 7 in Glacier National Park. The North Fork Road traverses Sections 19 and 18 in T34N, R20W, and winds northwest through Sections 13 and 11 in T34N, R21W. Many of the views of the east-facing slope of Winona Ridge are obscured by buffers of trees lining the North Fork Road. However, where the North Fork Road leaves Section 18 in T34N, R20W, and enters Section 13 in T34N, R21W, an opening through which the northeast face of Winona Ridge is visible occurs on Tom Ladenburg's property,. It is from this viewpoint that the existing visual quality will be described from 3 different points:

Foreground

- North Fork Road to one-quarter mile - The driveway heading northwest toward Ladenburg's property can be seen. A fence and several dwellings are located on the southeast side of the driveway. Overall the property consists of rangeland with a few open-grown Douglas-fir and lodgepole pine trees.

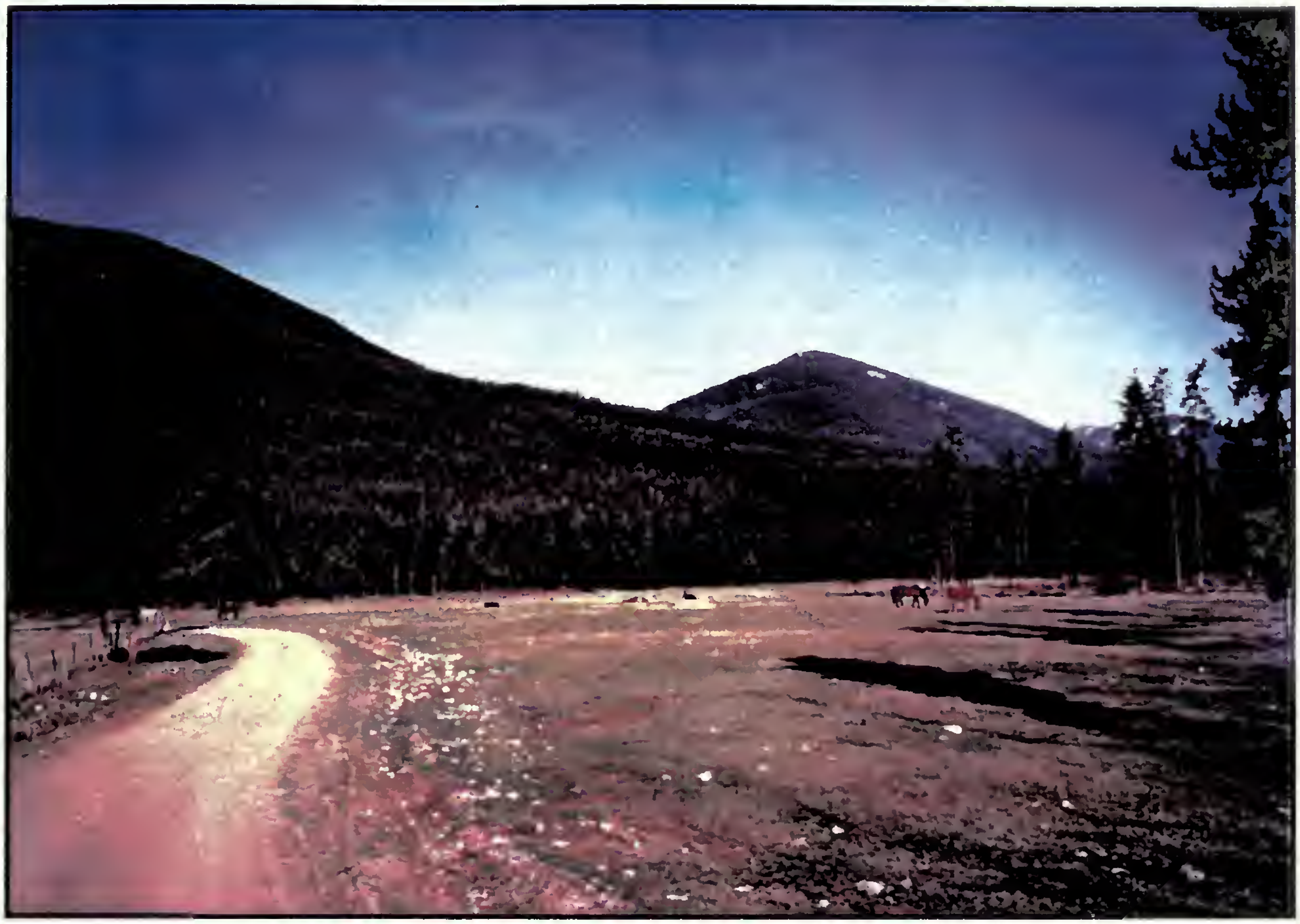
Middleground

- One-quarter mile to one-half mile - One can see the driveway winding back to Ladenburg's cabin. The base of Winona Ridge, which is on private property and has been managed for an even-aged stand condition, can be viewed behind the cabin. A mixed-conifer stand on DNRC ownership, which is west of and adjacent to Ladenburg's property, can also be seen from this viewpoint and has also been managed for an even-aged condition.

Background

- More than one-half mile - The northeast face of Winona Ridge (E1/2 of Section 14, T34N, R21W), and the southeast face of Cyclone Peak (Section 9, T34N, R21W), including Cyclone Peak Lookout, can be seen (see Figure III-17, Photograph of Section 14) Two roads running north/ south, located midway up Winona Ridge in Section 14, are partially visible. A draw runs northeast from the southcentral point of Section 14 through a lodgepole pine and subalpine fir stand. In 1936, a fire burned through the north side of this draw, creating 2 distinctly visible age classes of subalpine fir. Northwest of the draw, toward the peak of Winona Ridge, a lodgepole pine stand exists. A darker green, subalpine fir stand is located just below the lodgepole pine stand. Unit 2, consisting of subalpine fir, Douglas-fir, and western larch, is located just below this subalpine fir stand and, due to the lighter color of the stand, is distinguishable from the unit above.

Figure III-17 Photograph of Section 14



The southeast face of Winona Ridge (Section 23, T34N, R21W) can also be seen from this viewpoint. Due to the large percentage of lodgepole pine in this stand that were killed by the mountain pine beetle infestation in the 1980s, small openings can be viewed from the valley below. The base of the southeast face of Winona Ridge is on Ladenburg's property and has been managed for an even-aged condition.

ECONOMICS

CURRENT CONDITIONS

Demand for timber sales in the northwest region of Montana (Flathead, Lake, Lincoln, and Sanders Counties) is poor (7/98), and the future outlook is uncertain. Only one potential purchaser has bid on the two last timber sales offered by the Stillwater Unit. Based on recently sold DNRC sales from Western Montana it appears that the stumpage prices have fallen about 25% from last year. "The U.S. economy remains very strong with high building activity and wood product consumption, but we expect reduced production later in the year unless Japan and other Asian economies improve," says Bureau of Business and Economic Research Director of Forest Industry Research, Charles Keegan. Lumber production was up 6% for the first quarter of this year compared to the first quarter of 1997, and production employment is also up by 1.5% for the same period (New Release - Mild Winter Boosts Montana's Lumber Production, June 1, 1998, Keegan). DNRC feels that the stumpage prices and demand will probably not increase until next year's building season because of high production levels, the current lumber and log supply in the market, and the current economic problems in Asia. If the U.S. economy weakens (reductions in housing starts), stumpage prices and demand could soften further.

Based on a past study, The Role of the Wood Products Industry in the Economy of Flathead County, Montana, An Estimate of the Effects on Total Employment Using Input-Out Analysis, 20% to 35% of the economy of Flathead County can be attributed to the wood products industry. This estimate of the economic effect of the wood products industry was determined primarily with the use of the computer program Micro Implan, an economic impact model based on county- level economic data (Beckley, 1994).

PAST HARVEST FROM THE COAL CREEK STATE FOREST

Table III-21 is a review of past harvest activity in Coal Creek State Forest.

SUSTAINED-YIELD LEVELS

Table III-22 is the current sustained-yield volume level for the Northwest Land Office and statewide.

TABLE III-21 HISTORICAL HARVEST VOLUMES AND VALUES OF COAL CREEK STATE FOREST

Year in Class	Total Volume (MBF)	Total Value Nominal $'s	Total Value 1997 $'s
0-1950	0	$73	$480
1951-1960	7,194	$89,250	$448,891
1961-1970	4,441	$167,550	$681,085
1971-1980	18,543	$970,561	$2,541,125
1981-1990	12,780	$335,890	$467,723
1991-1998	50	$3,632	$3,817
TOTAL	43,008	$1,566,956	$4,143,125
Yearly Average since 1951	915	$33,338	$88,141

TABLE III-22 THE AVERAGE ANNUAL SUSTAINED-YIELD-VOLUME TOTAL AND PER ACRE FOR NORTHWEST LAND OFFICE AND STATEWIDE

	NWLO	Statewide
1. Sustained yield harvest (MBF)	23,559[1]	42,164[2]
2. Net forested acres in sustained yield study	185,449[1]	363,783[2]
3. Annual harvest BF/acre (row 1 *1000/row 2)	127	116

[1] Memo Dated April 16, 1998, NWLO net acres and ave. sys. harvest, Brian Long (Brian Long references Plan 96G, Arney letter, 12/20/96).

[2] Montana State Lands Sustained Yield Study 1996

The Montana State Lands Sustained-Yield Study 1996 assumed that the manageable (net nondeferred) acres in Coal Creek Forest equal 6,343 acres. (This number is from the sustained-yield database table "admin.dbf" and field "rept_acres". See Montana State Lands Sustained Yield Study 1996 for details regarding what was deferred and why). An estimate of the average annual contribution from Coal Creek State Forest is 806 MBF per year. This is based on NWLO's annual harvest of 127 BF per acre multiplied by the 6,343 acres in Coal Creek State Forest.

COSTS AND REVENUES FROM THE DNRC FOREST SALE PROGRAM

DNRC does not have a formal accounting system to track costs for individual projects from start to finish. An annual cash-flow analysis was conducted on DNRC's forest product sales program. Revenue and costs are calculated by land office and Statewide. The revenue-to-cost ratios is a measure of economical efficiency. A ratio value less than 1.0 means that the costs are higher than the revenues (losing money). A ratio greater than 1.0 means that revenues are higher than the costs (making money). A ratio equaling 1.0 means that the costs equal the revenues. Ratios for the Northwestern Land Office for fiscal year 1994 was 3.33, with 2.41 for 1995, 1.51 for 1996, and 1.52 for 1997. For the last two years for every 1.0 dollar we spent on costs the Northwest Land Office has generated $1.51 in revenue. In order to maintain long-term profitability, the Northwest Land Office needs to either reduce costs (MEPA, sale preparation, sale administration, road related costs or treatment costs) or increase revenue.

Total revenue is revenue from timber sales, permits, FI, and road maintenance, and total cost is the sum of timber operating and general administration costs. Net Return is total revenue less total cost. Specific information on assumptions related to revenue or cost is contained in the User's Guide for Timber Accounting Summary (TAS), Montana Department of State Lands.

TABLE III-23 THE NET RETURN/TOTAL REVENUE AND REVENUE/COST RATIOS (TIMBER SALE ACCOUNTING SUMMARY - FY95 AND REVISED FY94 MEMO, FY96, FY97)

	Net Return/Total Revenue Ratio				**Total Revenue/Total Cost Ratio**			
	FY94	**FY95**	**FY96**	**FY97**	**FY94**	**FY95**	**FY96**	**FY97**
Northwest Land Office	0.70	0.59	0.34	0.34	3.33	2.41	1.51	1.52
Total Program	0.63	0.52	0.40	0.47	2.68	2.07	1.68	1.89

CHAPTER IV
ENVIRONMENTAL CONSEQUENCES

INTRODUCTION

Chapter IV describes the environmental effects of each alternative on the resources described in Chapter III, and provides the basis for the summary of environmental effects table at the end of Chapter II. An economic analysis is also presented. Included at the end of this chapter is a list of proposed mitigations common to all of the timber-harvesting alternatives.

PROJECTS UNDER CONCURRENT CONSIDERATION

The cumulative effects of past activities are discussed in Chapter III. The related projects under concurrent consideration in the Coal Creek State Forest analysis area is the USFS's Dead Horse Burn Timber Sale. The Dead Horse Burn Timber Sale has been included in the cumulative effects analysis for the proposed Cyclone/Coal Timber Sale. Also, a blowdown event in 1997, located on the south side of Coal Creek in Section 30, T34N, R21W, will be sold in the summer of 1998 and will be included in this cumulative effects analysis.

FOREST CONDITIONS

OVERVIEW

The analysis of the affected environment indicates that Coal Creek State Forest contains slightly more old growth than in the 1930s, but considerably fewer acres today in stands under age 40. It also contains, approximately, twice as many acres of old-growth stands as we have committed to retaining through the SFLMP. Analyses suggest the forest has considerably more acres in mixed-conifer and subalpine cover types than the appropriate vegetative condition for achieving SFLMP objectives. Correspondingly, Coal Creek State Forest is lacking western larch/Douglas-fir cover types and old-growth stands of western larch/Douglas-fir. Patch sizes have become smaller since the 1930s, while patch shapes have increased in complexity.

This effects analysis focuses on describing how the various alternatives move the forest toward or away from appropriate conditions as determined by DNRC to meet the SFLMP objectives.

EFFECTS ON COVER TYPE

Each action alternative focuses on moving Coal Creek State Forest in the direction of DNRC's determined appropriate condition, but with slightly different emphases. As such, the various alternatives achieve some goals for appropriate conditions better than others.

Alternatives A and F would not immediately affect cover type; however, over time, without treatment or disturbance, cover types would continue the demonstrated trend to greater representation of shade-tolerant cover types, specifically the mixed-conifer and subalpine types.

Alternative B targeted the conversion of mixed-conifer and subalpine types into western larch/Douglas-fir cover types. This alternative increases the amount of western larch/Douglas-fir cover type by 530 acres (from 51 to 581 acres) by converting 320 acres of mixed conifers, 190 acres of subalpine types, and 20 acres of lodgepole pine. Harvesting also occurs in 183 acres of the Douglas-fir type, 179 acres of lodgepole pine, 51 acre of western larch/Douglas-fir, and 9 acres of western white pine type. Postharvest cover-type representation would be 183 acres of Douglas-fir, 159 acres of lodgepole pine, 580 acres of western larch/Douglas-fir, and 9 acres of western white pine.

Alternative C also targets conversion of mixed-conifer and subalpine types into the western larch/Douglas-fir cover type, but would do so largely by commercial thinning from below. This alternative would increase the western larch/Douglas-fir cover type by 770 acres (from 64 to 834 acres). The reduction of 520 acres of the mixed-conifer and 230 acres of the subalpine cover types, and 20 acres of the lodgepole pine type allows the increase in the western larch/Douglas-fir cover type. Acres harvested by cover type are subalpine, 230; Douglas-fir, 183; lodgepole pine, 179; mixed conifer, 520; western larch/Douglas-fir, 64; and western white pine, 50. Postharvest cover-type acres are subalpine, 0; Douglas-fir, 183; lodgepole pine, 159; mixed conifer, 0; western larch/Douglas-fir, 834; and western white pine, 50.

Alternative D has similar objectives to Alternative B. Through the even-aged harvesting of the mixed-conifer and subalpine cover types, it would increase the western larch/Douglas-fir cover type by 504 acres. The lodgepole pine cover type would be reduced by 20 acres. Acres harvested by cover type are subalpine, 164; lodgepole pine, 179; mixed conifer, 320; and western larch/Douglas-fir, 37. Postharvest cover-type acres are subalpine, 0; lodgepole pine, 159; mixed conifer, 0; and western larch/Douglas-fir, 540.

Alternative E would increase western larch/ Douglas-fir cover types by 744 acres through conversion of mixed-conifer and subalpine cover types by commercial thinning from below. The lodgepole pine cover type would be reduced by 20 acres. Acres harvested by cover type are subalpine, 204; lodgepole pine, 179; mixed conifer, 520; western larch/Douglas-fir, 50; and western white pine, 42. Postharvest cover-type acres are subalpine, 0; lodgepole pine, 159; mixed conifer, 0; western larch/Douglas-fir, 794; and western white pine, 42.

The western larch/Douglas-fir cover type was determined to be the most underrepresented cover type on Coal Creek State Forest. Each action alternative moves the forest in the direction of appropriate conditions for cover-type representation by increasing the western larch/Douglas-fir cover type. The alternatives accomplish the conversion through different harvesting methods: Alternatives B and D do so largely through even-aged stand-replacement harvests, while Alternatives C and E do so through removal of mid- and understory shade-tolerant species. The effects of the harvest methods are demonstrated in other categories discussed below. For conversion of the largest number of acres to western larch/Douglas-fir cover types, Alternative C moves us the farthest in the desired direction.

AGE-CLASS DISTRIBUTIONS

Our analyses show approximately 35% of Coal Creek State Forest is in old-growth stands (see Table IV-1). This equates to over twice our minimum commitments from the SFLMP. However, our analyses also show that old-growth western larch/Douglas-fir is underrepresented, while all other cover types (except lodgepole pine) are over the minimum commitment, especially the mixed-conifer and subalpine.

Alternatives A and F would not immediately affect age-class distributions or old-growth amounts. However, over time, in the absence of treatment or disturbance, old-growth and older-age stands would increase their representation.

Alternative B would reduce old-growth acres by 460 to 4,846 acres. This would occur through even-aged harvesting of old-growth mixed-conifer stands (321 acres), subalpine stands (103 acres), and western larch/Douglas-fir stands (36 acres). The 0-to-39-year age class would be increased by 656 acres (see Table IV-2). Harvesting would occur in a total of 678 acres of old growth; however, 218 of those acres would remain old growth, albeit with decreased amounts of some attributes (see Old-Growth Attributes section). Age-class distributions would show a decrease to 32% old growth and an increase to 16% young stands. The 32% represents the same proportion as was measured in the 1930s' inventory while the 16% is considerably lower than the 47% measured in the 1930s.

Alternative C would reduce old-growth stands by 42 acres to 5,264 acres (see Table IV-2). Harvesting would occur on 973 acres of old-growth stands largely by thinning from below the main canopy. The treatments would result in 931 acres of stands still being considered as old growth postharvest, but would result in decreases in some old-growth attributes (see Indicators of "Old-Growth" Attributes, discussion for analysis of effects on structural characteristics commonly associated with old growth, Chapter III).

Alternative C slightly changes the existing age-class distribution. This occurs due to the harvest methods selected, which remove shade-tolerant intermediates and some shade-intolerant species. The result is that many stands will show a change in species composition to a western larch/Douglas-fir cover type and this is reflected in the results in cover-type representation (see Effects on Cover Type). Old-growth proportions would not be reduced, but several attributes would be reduced. The proportion of young stands would increase to 13%.

Alternative D would reduce old-growth stands by 460 acres to 4,846 acres. The, primarily, even-aged harvests with reserves, would change stand age effectively to 0. Only 21 acres of harvested old growth would remain old growth postharvest. An increase of 678 acres would occur in the 0-to-39-year age class postharvest (see Table IV-2). Age-class distribution effects would roughly mirror those of Alternative B.

Alternative E would reduce old growth stands by 42 acres to 5,264 acres. Harvesting would occur in 776 acres of old-growth stands. The 0-to-39-year age class would increase by 260 acres (see Table IV-2). Alternative E's harvest prescriptions are similar to Alternative C, but enters fewer acres. Age-class distribution effects would roughly mirror those of Alternative C.

Each alternative meets SFLMP commitments for old-growth retention, though the approaches are quite different. Alternatives B and D convert many acres of old-growth stands to stand initiation through emulation of a stand-replacement fire. The 1930s' inventory showed that 49% of all Coal Creek State Forest was in stands under 40 years of age, which mostly developed following a large fire in the early 1900s. Thus, these 2 alternatives help move Coal Creek State Forest toward a more appropriate overall age-class distribution, albeit at the expense of retaining old-growth stands.

Currently, Coal Creek State Forest is lacking sufficient acres of old-growth western larch/Douglas-fir stands. Consequently, Alternatives C and E would move the forest the farthest in the desired direction by converting 678 acres of old-growth mixed-conifer and subalpine cover types to western larch/Douglas-fir stands (harvesting in existing western larch/Douglas-fir old growth would result in a net increase of 643 acres of old-growth western larch/Douglas-fir). The other alternatives would harvest old-growth stands, but they would not remain old growth postharvest. None of the alternatives reduces old-growth acres to near our minimum-retention requirement. In the conversion of old-growth stands from one type to another, several attributes associated with old growth would be reduced. For more information, see Appendix D on harvest effects on old-growth attributes.

TABLE IV-1 EFFECTS OF EACH ACTION ALTERNATIVE ON AGE-CLASS DISTRIBUTION FOR COAL CREEK STATE FOREST

Alternative	0-to-39-year (%)	40-to-100-year (%)	100-to-150-year (%)	150-year and more (%)
A	11	37	17	35
B	16	36	16	32
C	13	36	16	35
D	16	36	16	32
E	13	36	16	35
F	11	37	17	35

TABLE IV-2 THE MINIMUM NUMBER OF OLD-GROWTH ACRES TO MAINTAIN AND POSTHARVEST ACRES OF OLD GROWTH BY COVER TYPE PER EACH ALTERNATIVE IN COAL CREEK STATE FOREST*

Cover Type	Minimum Old-Growth Acres to Maintain	Postharvest Acres of Old Growth		
		A and F	B and D	C and E
Ponderosa pine	0	0	0	0
Douglas-fir	36	710	710	710
Western larch/Douglas-fir	1,489	618	603	1,261
Western white pine	56	443	443	443
Lodgepole pine	91	0	0	0
Mixed conifer	299	2,277	1,956	1,757
Subalpine	188	1,258	1,134	1,094
TOTALS	2,159	5,306	4,846	5,264

*There are 15,094 forested acres on Coal Creek State Forest

Alternatives C and E harvest old-growth stands from the middle and lower stories, retaining the majority of the large overstory trees, and, therefore, remain as old-growth stands. Both alternatives contribute to correcting the current deficit of old-growth western larch/Douglas-fir stands.

None of the alternatives move us away from appropriate age-class distributions, but they do accomplish different objectives for the overall forest conditions of cover-type and age-class distributions.

VIGOR

The vigor of Coal Creek State Forest, overall, would be only slightly affected. Currently, vigor for Coal Creek State Forest is 2.42 (where full vigor equals 1, good equals 2, fair equals 3, and poor equals 4). Alternative B would change vigor to 2.33; Alternative C would change vigor to 2.38; Alternative D would change vigor to 2.35; and Alternative E would change vigor to 2.40. Alternatives A and F would not change vigor rating except over time where lack of treatment or disturbance would tend to decrease vigor. Each action alternative improves vigor, with Alternatives B having a slightly greater effect than the other alternatives.

STRUCTURE

The structure of forested stands on Coal Creek State Forest would be affected by the action alternatives. Preharvest conditions show 44% of Coal Creek State Forest is in single-storied stands; 6% in two-storied stands; 36% in multistoried stands; and 14% in stands of even-aged clumps.

Alternatives A and F would not immediately affect stand structure. However, over time in the absence of treatment or disturbance, it is expected that the multistoried condition would increase with decreases in all other stand structures.

Each action alternative would shift the overall representation of structure, as shown in Table IV-3.

TABLE IV-3 STAND STRUCTURE EFFECTS OF THE VARIOUS ACTION ALTERNATIVES*

Alternative	Single-storied		Two-storied		Multistoried		Even-aged Clumps	
	Acres	%	Acres	%	Acres	%	Acres	%
A	6,588	44	925	6	5,420	36	2,085	14
B	6,970	46	925	6	5,166	34	1,957	13
C	6,686	44	925	6	5,369	36	2,046	14
D	6,987	46	925	6	5,154	34	1,958	13
E	6,681	44	925	6	5,370	36	2,045	14
F	6,593	44	925	6	5,420	36	2,085	14

*Nonstocked acres receive no structure designation.
NOTE: In all tables acres and percents may reflect the effects of rounding when totaled.

None of the alternatives has a large effect on the overall Coal Creek State Forest stand structural distribution. However, Alternatives B, and D could, if the same pattern of change continued with future entries, affect the overall distribution of stand structures on Coal Creek State Forest. Alternatives B and D would begin to shift toward single-storied stands. When expressed as a percentage, neither Alternative C or E appears to shift structure; however, each reduces the acres in both the multistoried and even-aged clumps conditions.

OLD-GROWTH ATTRIBUTES

INDICATORS OF "OLD GROWTH" ATTRIBUTES

As displayed earlier (Table IV-2), the current 5,306 acres of "old growth" would be reduced to approximately 4,846 acres under Alternative B; 5,264 acres under Alternative C; 4,846 acres under Alternative D; and 5,264 acres under Alternative E. Except for Unit 3, all of these amounts of old growth meet or exceed the minimum acreage of old growth that are required to be maintained, by cover type, under our SFLMP commitments. However, it is still appropriate to ask 2 questions for each alternative:

- Is old growth, that is subject to entry, a biased selection of available old growth with respect to quantifiable "old-growth" attributes (e.g., abundance of large trees, snags)?
- Will the proportional acreage of old growth by each of these attributes approximate the current situation following harvest?

The following analyses address these questions by comparing the proportional old-growth attributes of old growth entered to those available, and postharvest old-growth attributes to current conditions.
To assess postharvest conditions, we developed a simple model that projects the category of abundance for each of the 4 attributes for each possible harvest treatment (Appendix D). For example, under a modified-clearcut harvest, the abundance of large trees is projected to change to "few" if currently "some" or "many", but would only go down a single category under a thinning treatment.

RELATIVE ABUNDANCE OF LARGE, LIVE TREES

Fig. IV-1 displays the proportion of old growth in each of the 4 large tree indices existing currently in Coal Creek State Forest ("existing"), as well as the proportions of old growth subject to some type of harvest under each action alternative (Alternatives B through E). This comparison provides an assessment of whether stands selected for harvest are biased in some way, relative to their availability among old growth considered. In all cases, the proportion of stands subject to entry with "many" large trees is higher than the corresponding proportion of the existing forest. The discrepancies are noteworthy in Alternatives D and E and considerably less severe in Alternatives B and C. Acreage of old growth with no or few large, live trees (about 10%) may be stagnated or recently harvested stands. Fig. IV-2 emphasizes the differences among alternatives by displaying the acreage of old growth entered, categorized by these indices of large-tree abundance.

Fig. IV-1. The proportion of stands categorized as "old" proposed for some type of treatment ("entry") under each alternative in each category of the relative abundance of large live trees. Proportions shown refer to existing acreage classified by abundance categories "none", "few", "some", and "many" (large, live trees). Also shown are the proportions in each category in the existing environment.

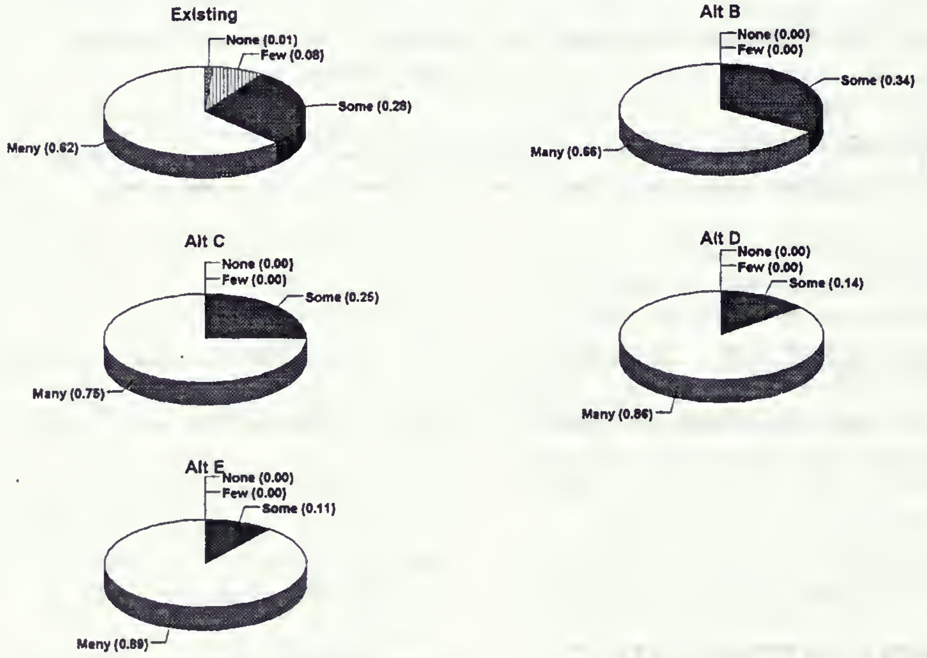


Fig. IV-2. Acreage of stands categorized as "old" proposed for some type of entry under each alternative, by the relative abundance of large, live trees.

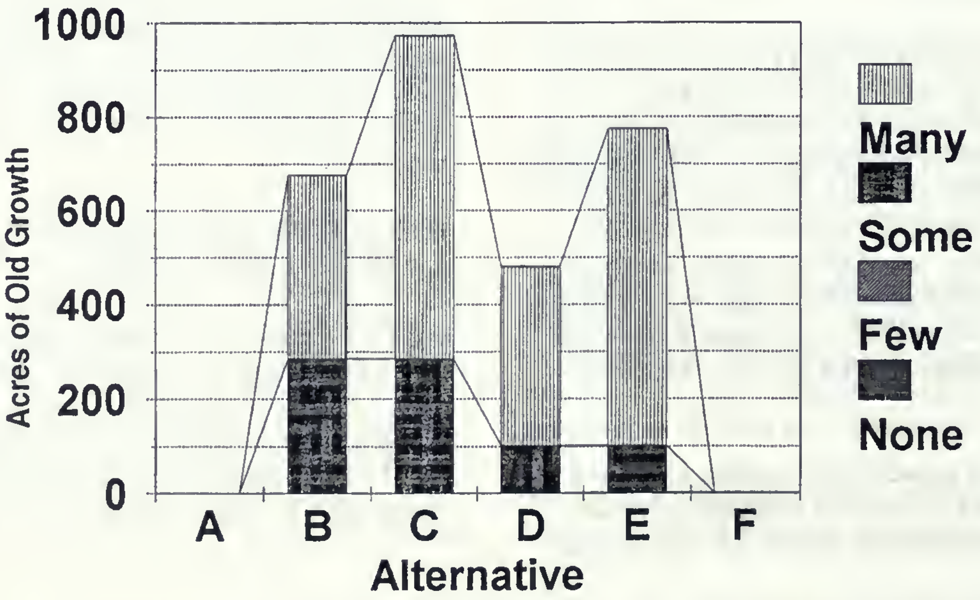


Fig IV-3. The proportion of stands projected to be categorized as "old" posttreatment for each alternative in each category of the relative abundance of large, live trees. Shown above each individual pie are the number of acres projected to be categorized as "old" following treatment.

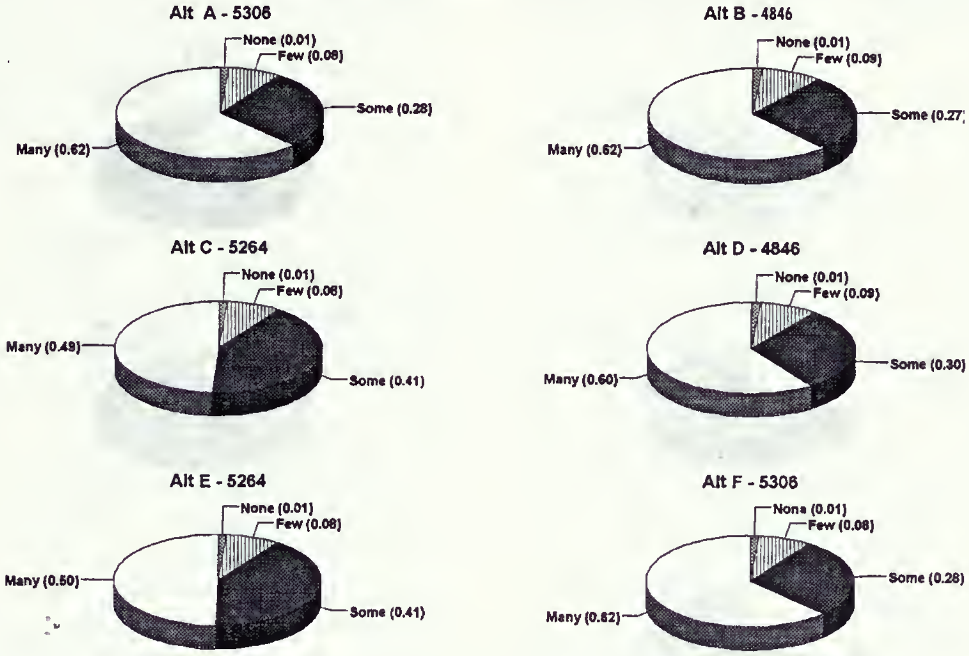


Fig. IV-3 displays the projected proportions of old growth in each large-tree category for each alternative following harvest. The acreage remaining in the "old growth" category is shown above each pie chart. To compare the actual acreage in each category across alternatives, one must consider both the projected proportion of old growth and the projected acreage of old growth. Thus, the total acres in the "many large tree" condition would be approximately 2,869 under Alternative B and 2,908 under Alternative D. Similarly, although Alternative E results in only 50% of postharvest "old growth" being categorized as having "many" large trees, this acreage (2,632 acres) is not as much smaller than Alternative B than it appears from Fig. IV-3.

In all cases, the "many" large-trees category remains the dominant one, and all proportions are roughly similar to the existing condition (i.e., Alternatives A and F). However, because the acreage of old growth is not constant among alternatives, the acreage with these old-growth characteristics roughly follows that for the "old growth" analyses. However, it is clear that "old growth" stands chosen for harvest, usually for reasons of undesired succession or insect/disease problems, tend to be those with many large trees, whereas fewer stands with "no" or "few" large trees are selected. If this trend were to continue, future "old growth" would, on average, contain fewer large trees than is currently the case.

RELATIVE ABUNDANCE OF LARGE SNAGS

Fig. IV-4 provides a comparison of stands entered under each alternative to existing stands with regard to abundance of snags. In general, stands selected for entry are more likely to be in the higher abundance categories than is characteristic of all old growth on Coal Creek State Forest. Very few acres categorized as having "few" or "no" snags were selected for entry in any of the action alternatives. Such selection was not intentional, but may have resulted from the objectives, common to all alternatives, to move certain stands from shade-tolerant to shade-intolerant dominance, and/or to recoup commodity values from insect/disease-infested stands. Regardless, the trend suggested is that stands with higher snag abundances tend to be those selected for entry. Fig. IV-5 compares

Fig. IV-4. The proportion of stands categorized as "old" proposed for some type of treatment ("entry") under each alternative in each category of the relative abundance of snags. Proportions shown refer to existing acreage classified by abundance categories "none", "few", "some", and "many" (snags). Also shown are the proportions in each category in the existing environment.

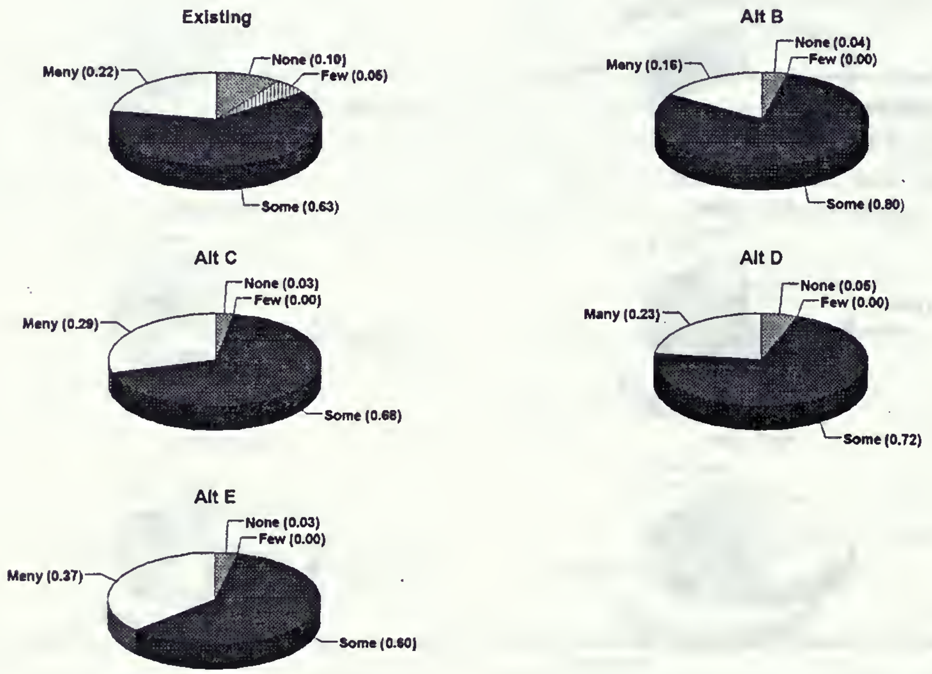
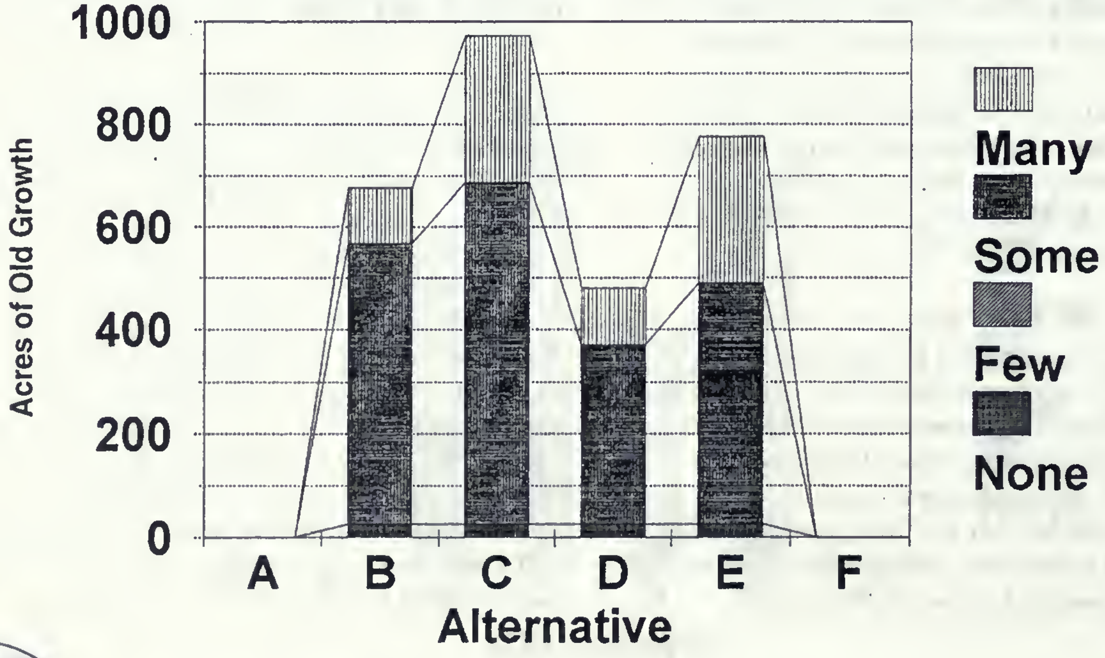


Fig. IV-5. Acreage of stands categorized as "old" proposed for some type of entry under each alternative, by the relative abundance of snags.



alternatives directly in terms of their entry into old growth with various abundance levels of snags.

Fig. IV-6 displays the projected proportions of old growth in each snag category for each alternative following harvest. The acreage remaining in the "old growth" category is shown above each pie chart. Differences among alternatives are considerably less evident viewed this way than viewed in terms of stands entered (Figs. IV-4, IV-5). This is due, in part, to the more conservative treatments applied in those alternatives that enter the most acres of old growth. Thus, for example, viewed in terms of stand entry alone, Alternatives C and E would appear to unduly target stands with many snags, avoiding stands with few; whereas Alternatives B and D would appear to enter stands that are closer to the proportional representation of all those available. However, treatments in Alternatives C and E are projected to be more successful at retaining existing snags than those of Alternatives B and D. Additionally, the total acreage projected to qualify as "old" posttreatment is greater under Alternatives C and E than B and D. The result is that we project roughly similar proportions of remaining "old" stands in the various snag-abundance categories posttreatment (Fig. IV-6), although the total acres in each category will vary by alternative.

RELATIVE ABUNDANCE OF COARSE, WOODY DEBRIS

As described in Chapter III, most (77%) of the existing old growth in Coal Creek State Forest was categorized by this analysis as having either little or no coarse woody debris. Ground-based surveys would suggest that this result has more to do with the inventory documentation procedure, or the categorization system used here, than with any true ecological dynamic. That is, our qualitative assessment is that most old growth in Coal Creek State Forest (the majority of which have never been subject to harvesting) have an abundance of coarse woody debris that would be considered relatively high by western Montana standards. These indices should be viewed as useful for comparing stands within Coal Creek State Forest, and for comparing the effects of various alternatives, but not for assessing the abundance of coarse woody debris relative to other standards.

Fig IV-6. The proportion of stands projected to be categorized as "old" posttreatment for each alternative in each category of the relative abundance of snags. Shown above each individual pie are the number of acres projected to be categorized as "old" following treatment.

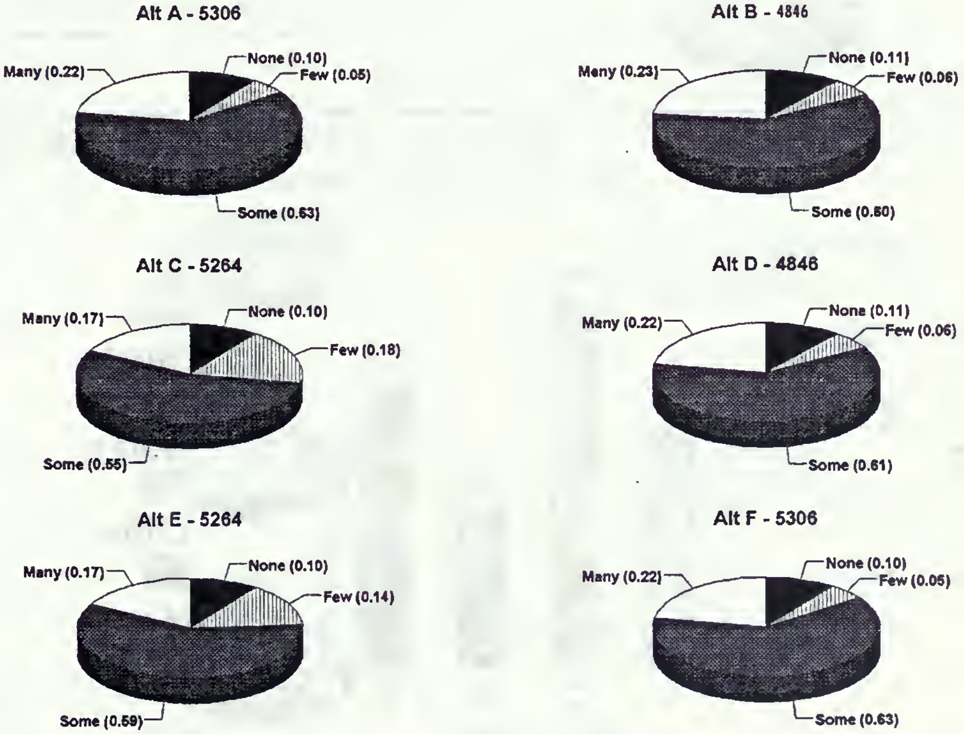


Figure IV-7 suggests considerable variation among stands subject to harvesting in each alternative in terms of the abundance of coarse woody debris in existing old growth. For example, 18% of old growth entered under Alternative D have "some" coarse woody debris, compared with an available proportion of only 3% of all old growth. Fig. IV-8 emphasizes differences among alternatives in acreage of old growth in each of the possible coarse woody debris categories.

In contrast, our projection of future conditions following treatments suggest that remaining old growth will be surprisingly similar to their current conditions with regard to coarse woody debris abundance (Fig. IV-9). Harvest prescriptions, including those intended to remove most of the existing standing, live trees, generally call for retaining considerable amounts of coarse woody debris.

Fig. IV-7. The proportion of stands categorized as "old" proposed for some type of treatment ("entry") under each alternative in each category of the relative abundance of coarse woody debris (CWD) on the ground. Proportions shown refer to existing acreage classified by abundance categories "none", "little", "some", and "much". Also shown are the proportions in each category in the existing environment.

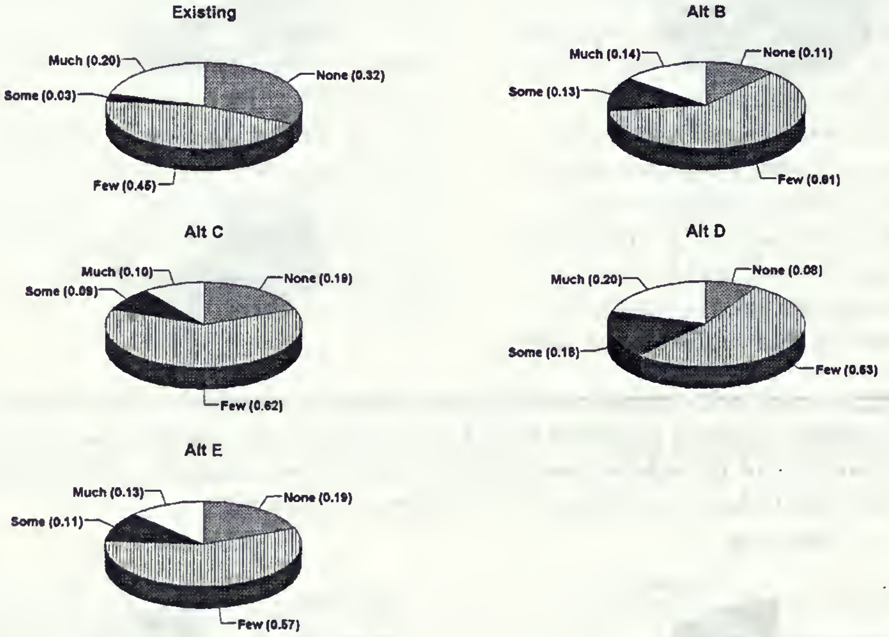


Figure IV-8. Acreage of stands categorized as "old" proposed for some type of entry under each Alternative, by the relative abundance of coarse woody debris on the ground.

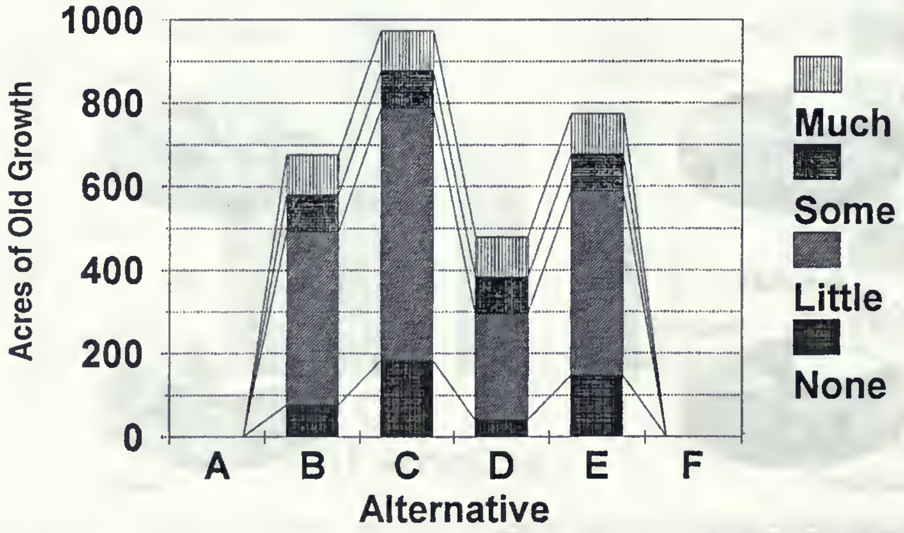
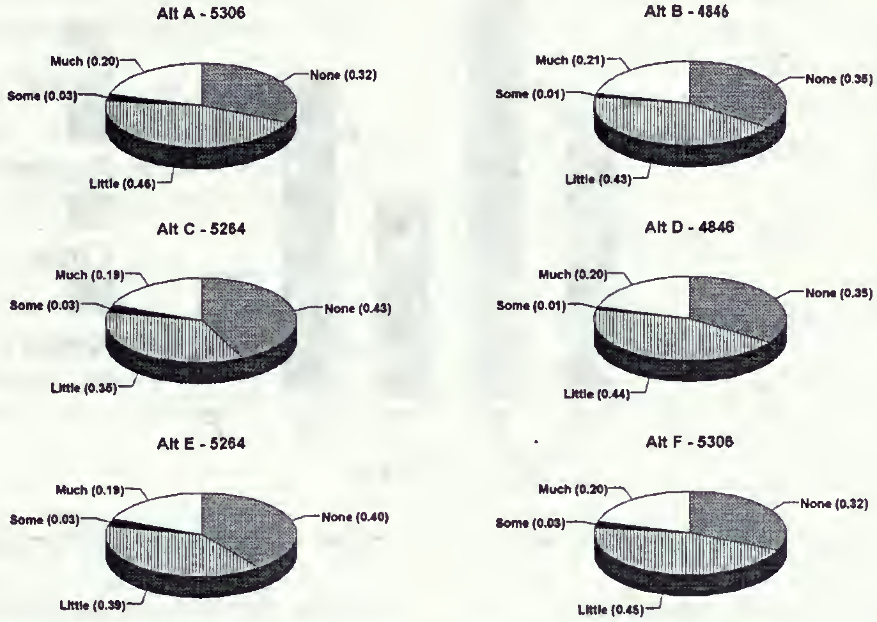


Fig IV-9. The proportion of stands projected to be categorized as "old" posttreatment for each alternative in each category of the relative abundance of coarse woody debris (CWD) on the ground. Shown above each individual pie is the number of acres projected to be categorized as "old" following treatment.



RELATIVE ABUNDANCE OF DECADENCE

Fig. IV-10 provides a comparison of stands entered under each alternative to existing stands with regard to abundance of decadence. Alternatives C and D would enter stands that are characterized by similar proportions in each decadence category to all old growth available. Alternative B would enter stands with generally a bit less decadence than characterizes Coal Creek State Forest stands as a whole, and Alternative E would tend to favor entering stands with decadence. Fig. IV-11 contrasts each alternative directly by acres entered.

Fig. IV-10. The proportion of stands categorized as "old" proposed for some type of treatment ("entry") under each alternative in each category of the relative abundance of decadence. Proportions shown refer to existing acreage classified by abundance categories "none", "little", "some", and "much" (decadence). Also shown are the proportions in each category in the existing environment.

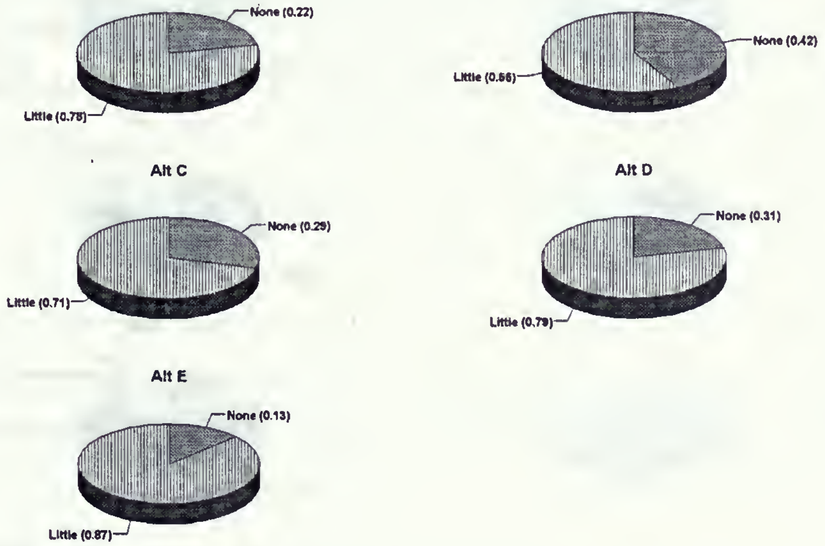
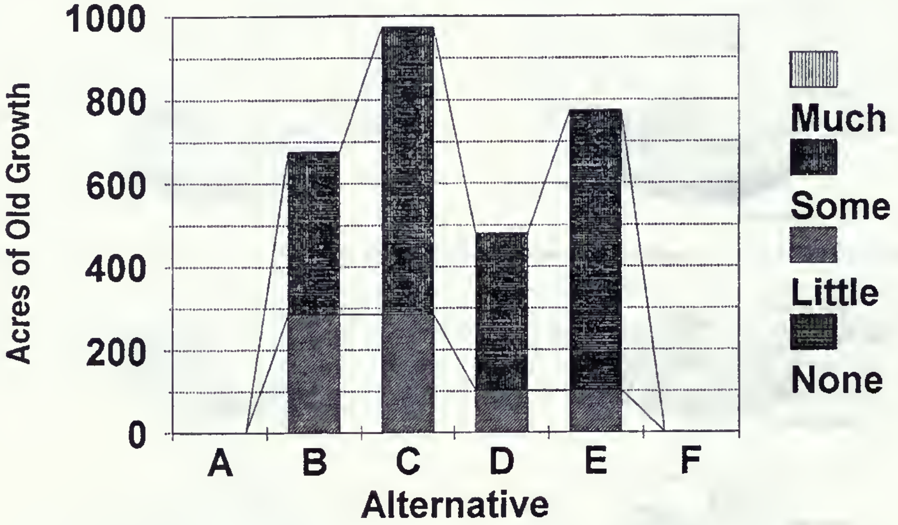
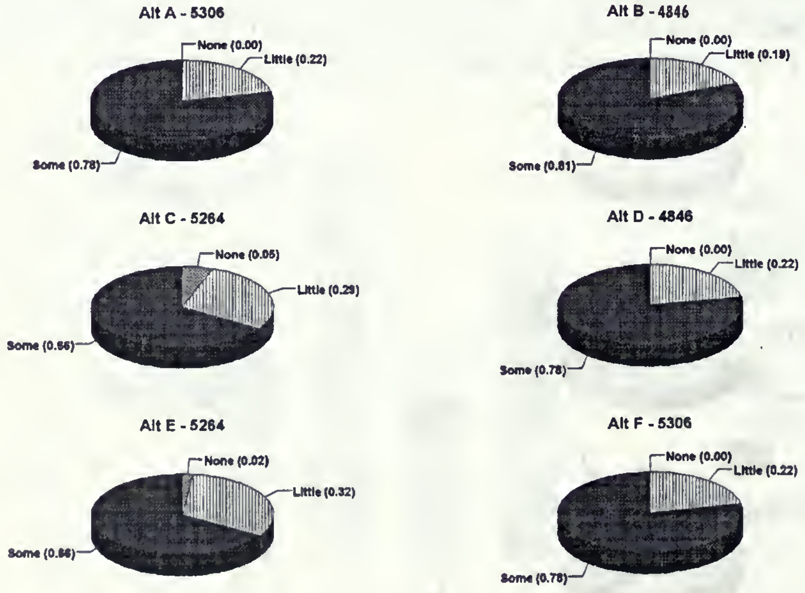


Fig. IV-11. Acreage of stands categorized as "old" proposed for some type of entry under each alternative, by the relative abundance of decadence.



As with the analysis of coarse woody debris, however, differences in proportional representation of decadence categories postharvest appear to be moderated by prescriptions (Fig. IV-12). Alternatives C and E would reduce the proportional representation of old growth with the most decadence, but they also retain a greater total acreage of old growth than do Alternatives B and D. Thus, even the small differences among alternatives suggested by Fig. IV-12 may exaggerate the true effects.

Fig IV-12. The proportion of stands projected to be categorized as "old" posttreatment for each alternative in each category of decadence. Shown above each individual pie are the number of acres projected to be categorized as "old" following treatment.



VIGOR OF OLD-GROWTH STANDS

Vigor can serve as a surrogate for decadence, another attribute associated with old growth. Stands with low vigor indicate situations where mortality equals or exceeds tree growth.

Alternatives A and F (Table IV-4) would not immediately affect the vigor of old-growth stands. However, over time in the absence of treatment or disturbance, old-growth vigor would decrease.

Alternative B has a slight effect on the vigor of old-growth stands. The movement of 4% of old-growth stands into the full-vigor class is the largest effect, with the corresponding decrease of 4% in the good-vigor class. Overall, vigor is shifted toward higher vigor classes.

Alternative C has a pronounced effect on increasing the vigor of old-growth stands. This is especially evident in the reduction of fair vigor and corresponding increases in good and full vigor.

Alternative D retains the existing distribution of vigor of old-growth stands when percentages are used.

Alternative E has similar effects as Alternative C, with a large decrease in fair vigor and large increase in good vigor. The full-vigor class is only increased a minor amount, but good vigor is increased by 10%, while fair vigor decreases 11%.

Unlike other indicators of the vegetative condition, the effects on vigor are more pronounced and differ between alternatives. Both Alternatives C and E result in substantial shifts in vigor distribution in old-growth stands. While these are likely temporary and due to the removal of shade-tolerant trees in the midstory and understory, they reflect a major shift in the character of old-growth stands to a more vigorous condition and, probably, less decadent.

STRUCTURE

Structure of existing old-growth stands was described in Chapter III. Each alternative has only a slight effect on the overall distribution of old-growth structure. The main effects are that Alternatives B and D reduce the proportion of single-storied old-growth stands and slightly increase the proportion of multistoried old-growth stands. This is due to the harvesting of single-storied old-growth stands and returning them to the stand-initiation stage. The proportion of two-storied stands increases simply due to a reduction in the total old-stand acres. The increase in multistoried stands occurs due to a lower proportion of this structure being removed compared to single-storied stands. Alternative C increases multistory proportions and decreases two-storied old-growth stands. Alternative E maintains the current distribution of structural classes postharvest, and, therefore, best meets our guidance for old-growth attributes. Again, the effects are slight on the entire Coal Creek State Forest.

TABLE IV-4 - EFFECTS OF THE VARIOUS ACTION ALTERNATIVES ON THE VIGOR OF OLD-GROWTH STANDS IN COAL CREEK STATE FOREST

Alternative	Full (%)	Good (%)	Fair (%)	Poor (%)
A	0	22	78	0
B	4	19	78	0
C	5	29	67	0
D	0	22	78	0
E	2	32	67	0
F	0	22	78	0

TABLE IV-5 - EFFECTS OF THE VARIOUS ACTION ALTERNATIVES ON THE STRUCTURE OF OLD-GROWTH STANDS IN COAL CREEK STATE FOREST

Alternative	Single-storied (%)	Two-Storied (%)	Multi-storied (%)	Even-aged Clumps (%)
A	13	6	59	23
B	11	6	59	23
C	13	6	59	23
D	11	6	60	23
E	13	6	58	23
F	13	6	59	23

*Rows may not total 100% due to rounding.

SUMMARY OF EFFECTS: OLD-GROWTH ATTRIBUTES

All action alternatives would reduce the total acreage of old growth from that currently existing. Thus, the "slices" presented in Fig. IV-1 through Fig. IV-12 are from "pies" of different sizes. With this analysis, we address the issue: "Given that harvesting will reduce the total acreage of old growth (but not to levels below the minimums required by Resource Management Standards), will the remaining old growth be disproportionately those with more (or fewer) 'old-growth' attributes than at present?" We examined 5 attributes associated with the term "old-growth" (large trees, snags, coarse woody debris, decadence/vigor, and structure) independently, because their dynamics are not always coincident. We examined only these 5 attributes because we lacked data on others, but believe that general trends should be reflected in these 5.

In general, stands scheduled for entry under the action alternatives are more likely to have slightly higher abundances of the old-growth attributes examined than would a random selection of existing old growth. This tendency is most marked when examining the abundance of large, live trees, and least when examining the abundance of coarse woody debris. Because the total number of old-growth acres treated in any of the action alternatives is a small fraction of the total acres of existing old growth, none of the action alternatives would produce a substantial shift in the character of the overall remaining old growth. However, the tendency to enter those old growth with somewhat more than average large trees, snags, decadence, etc. would gradually alter the character of old growth toward those with less complex structure than currently exists, should similar objectives and methods characterize a series of future projects within Coal Creek State Forest.

This concern is tempered when viewed by projecting conditions postharvest. That is, although stands selected for entry tend to be those with greater abundances of old-growth attributes, the combination of prescriptions selected results in the remaining old growth retaining generally similar proportions of old-growth attributes to those currently in evidence.

This analysis suggests that, as future projects are proposed for Coal Creek State Forest, it will be important to maintain vigilance that those relatively few stands with high representation of old-growth characteristics are not disproportionately selected for treatments that would simplify their physical structure. In particular, there will almost invariably be a tendency to avoid harvesting in stands that, despite their older age, have relatively few large, live trees. Yet failure to do so would allow these stands (likely suppressed or on inferior sites) to constitute an increasing proportion of Coal Creek State Forest's "old growth", thus potentially compromising our commitment to retaining the full spectrum of forest types. Additionally, as future projects are proposed, it will be important to measure changes in the representation of stands with various old-growth attributes with respect to 1996 conditions (the baseline used here), rather than conditions at the time of analysis. Otherwise, a series of modifications, all of which were modest in their individual impact, could lead toward undesirably simplified structure in old growth without detection. With these concerns in mind, none of the present action alternatives appear to greatly alter the old-growth characteristics of the total array of old growth remaining after the project. Alternatives C and E move the proportion of remaining old growth in each attribute category further from current conditions than do Alternatives B and D. However, they do so by retaining a greater acreage of old growth than C and E, so that the net differences among alternatives with regard to the total amount of old-growth attributes remaining are rather minor.

PATCH SIZE AND SHAPE

PATCH SIZE AND SHAPE EFFECTS BY COVER TYPE

The effects of each alternative are shown in Tables IV-6, IV-7, IV-8, and IV-9.

The effects of Alternatives A and F would be to increase patch size of shade-tolerant cover types over time as succession replaced the shade-intolerant types.

The largest differences between the action alternatives occur with Alternatives B and D, showing larger mixed-conifer patch sizes than do Alternatives C and E, although all show a reduction from the current condition. The western larch/ Douglas-fir cover type shows an increase in patch size with Alternatives C and E, while Alternatives B and D remain roughly the same size. The mean patch size for all types is decreased in Alternatives B and D, but remains roughly the same in Alternatives C and E.

Patch-shape complexity is reduced slightly from current conditions under all alternatives. The greatest reductions are in Alternatives B and D.

TABLE IV-6 - COVER-TYPE PATCH SIZE AND SHAPE EFFECTS OF ALTERNATIVE B

Cover Type	n*	Mean Patch Size	Standard Deviation of Patch Size	Mean Patch Shape	Standard Deviation of Patch Shape
Subalpine types	23	161.2	232.2	1.689	0.615
Douglas-fir	18	69.6	65.5	1.453	0.200
Lodgepole pine	26	145.4	311.9	1.593	0.633
Mixed conifer	17	197.1	351.7	1.848	0.775
Western larch/ Douglas-fir	35	66.9	73.2	1.437	0.318
Western white pine	7	83.0	70.7	1.711	0.508
Totals	135	113.8	216.1	1.580	0.537

*Number of patches, totals include nonforest and water

TABLE IV-7 - COVER-TYPE PATCH SIZE AND SHAPE EFFECTS OF ALTERNATIVE D.

Cover Type	n*	Mean Patch Size	Standard Deviation of Patch Size	Mean Patch Shape	Standard Deviation of Patch Shape
Subalpine types	23	169.8	281.0	1.688	0.709
Douglas-fir	18	69.6	65.5	1.453	0.199
Lodgepole pine	26	145.4	311.9	1.593	0.633
Mixed Conifer	17	197.1	351.7	1.830	0.775
Western larch/ Douglas-fir	31	74.7	74.3	1.447	0.315
Western white pine	7	83.0	70.7	1.711	0.508
Totals	130	118.2	227.9	1.585	0.559

*Number of patches, totals include nonforest and water

TABLE IV-8 - COVER-TYPE PATCH SIZE AND SHAPE EFFECTS OF ALTERNATIVE E.

Cover Type	n*	Mean Patch Size	Standard Deviation of Patch Size	Mean Patch Shape	Standard Deviation of Patch Shape
Subalpine types	22	168.0	281.4	1.685	0.711
Douglas-fir	18	69.6	65.5	1.453	0.199
Lodgepole pine	26	145.4	311.9	1.593	0.633
Mixed Conifer	20	157.5	280.3	1.768	0.708
Western larch/ Douglas-fir	27	94.7	119.0	1.507	0.397
Western white pine	7	83.0	70.7	1.711	0.508
Totals	129	119.1	221.8	1.597	0.563

*Number of patches, totals include nonforest and water

TABLE IV-9. COVER-TYPE PATCH SIZE AND SHAPE EFFECTS OF ALTERNATIVE C.

Cover Type	n*	Mean Patch Size	Standard Deviation of Patch Size	Mean Patch Shape	Standard Deviation of Patch Shape
Subalpine types	23	159.5	232.6	1.686	0.617
Douglas-fir	18	69.6	65.5	1.453	0.199
Lodgepole pine	26	145.4	311.9	1.592	0.633
Mixed conifer	20	157.5	280.3	1.768	0.708
Western larch/ Douglas-fir	31	83.3	114.8	1.487	0.392
Western white pine	7	83.0	70.7	1.711	0.508
Totals	134	114.6	209.9	1.591	0.541

*Number of patches, totals include nonforest and water

PATCH SIZE AND SHAPE EFFECTS BY AGE CLASS

The age-class patch sizes and shapes show similar trends to cover-type patches.

Alternatives A and F, over time and in the absence of treatment or disturbance, would cause increased old-growth patch sizes simply through the aging of stands.

Alternative B and D reduce the overall patch size and increase the patch shape slightly. Alternatives C and E patch sizes remain roughly equivalent, while the shape index is slightly increased. The major difference between the alternatives is that Alternatives B and D reduce the mean old-growth patch size by, approximately, 75 acres, while Alternatives C and E remain the same.

Alternatives B and D would reduce old-growth patch size considerably through the harvesting of stand 34-21-28-05. This stand connects large patches of old growth north and south of the South Fork of Coal Creek. Previous harvesting has isolated this stand as the only old-growth connection across the South Fork. Overall, age-class patches would be reduced from a mean of 126 acres to a mean of 119.8 acres.

Both Alternatives C and E reduce old-growth patch size by about 4 acres to 350.9 acres mean patch size. Mean age-class patch size would be reduced from 126 acres to 124.7 acres.

TABLE IV-10 - AGE-CLASS PATCH SIZE AND SHAPE EFFECTS FOR ALTERNATIVES B AND D.

Age Class	n*	Mean Patch Size	Standard Deviation of Patch Size	Mean Patch Shape	Standard Deviation of Patch Shape
0-to 39-year	43	54.3	75.1	1.364	0.342
40-to-99-year	27	201.8	462.9	1.688	0.716
100-year to old growth stands	35	70.3	85.2	1.570	0.450
Old growth stands	21	230.7	546.0	1.899	1.153
Totals	126	119.8	319.1	1.580	0.670

*Number of patches

TABLE IV-11 - AGE-CLASS PATCH SIZE AND SHAPE EFFECTS FOR ALTERNATIVES C AND E.

Age Class	n*	Mean Patch Size	Standard Deviation of Patch Size	Mean Patch Shape	Standard Deviation of Patch Shape
0-to-39-year	44	43.6	51.3	1.332	0.329
40-to-99-year	27	201.8	462.9	1.689	0.715
100-year to old growth stands	35	70.3	85.2	1.568	0.451
Old growth stands	15	350.9	912.2	2.053	1.470
Totals	121	124.7	396.9	1.569	0.716

*Number of patches

SUMMARY OF EFFECTS

Each action alternative has different effects on the vegetation of Coal Creek State Forest. None of the alternatives best meets every goal of the project. However, Alternative C appears to best meet the most vegetation-related objectives, particularly converting stands to old-growth western larch/Douglas-fir cover types, having a minimal effect on the overall stand structure, improving vigor, not changing age-class distribution, and maintaining the largest old-stand patch sizes. The objectives where Alternative C does poorly include large changes in stand structure of old-growth stands toward higher representation of single-storied stands, and large shifts in old-stand vigor toward a more vigorous condition. This is largely due to treating old-growth stands in such a way as to retain their age, numbers of large live trees, snags, and some structure, but removing most of the midstory shade-intolerant species. This increases vigor, but decreases structural diversity and density. All the action alternatives meet most of the vegetation goals, such as cover-type conversion, age-class distributions, old-growth commitments, and the retention of old-growth attributes.

NOXIOUS WEEDS

NOXIOUS WEED MANAGEMENT

Noxious weeds are less likely to invade forested sites than nonforested sites; they, typically, spread along open roads and on barren slopes. The moist sites typical in the Coal Creek area support highly competitive vegetation. It is unlikely that knapweed will move off the roads and disturbed areas into surrounding forest sites. The effects of each alternative on the encroachment and establishment of noxious weeds are discussed.

EFFECTS OF ALTERNATIVE A ON NOXIOUS WEEDS

The No-Action Alternative would not directly affect the encroachment and establishment of noxious weeds. Alternative A would control established weed populations along open roads in accordance to the Flathead County Weed Management Plan. Spotted knapweed (Centaurea maculosa) would continue to be brought in on vehicles and spread along open roads and in disturbed areas where vegetation has not been established. Knapweed is the dominant vegetation on roadsides where erosion is above average due to less vegetative cover on soil surface.

EFFECTS OF ALL ACTION ALTERNATIVES ON NOXIOUS WEEDS

All of the action alternatives strive to prevent new establishment of noxious weeds and control established populations along open roads. For the action alternatives, an integrated-weed-management approach was considered. For this project, prevention, revegetation, and weed-control measures for spot outbreaks are considered the most effective weed-management treatments. Implementation of the following integrated-weed-management measures would reduce existing weeds and limit the possible spread of weeds:

- To prevent further establishment of noxious weeds, cleaning of all road construction and logging equipment of weed parts and mud is required prior to entering the site. Disturbed roadsides and landings would be revegetated with site-adapted grasses.

- Biocontrol agents, such as insects, would not be used because they do not work well in the stripwise population patterns that typify the project area along roads and the cold, moist climate would not support currently available biocontrol agents. Physical treatments, such as surface blading, can reduce the dispersal of seed, but would not control weeds on road cut-and-fill slopes.

- Where noxious weeds occur along existing access roads, an application of herbicide, followed by grass seeding, would attempt to control established weeds and promote desirable native plants and seed grasses that will compete with the noxious weeds and provide long-term soil stabilization to control erosion.

- The herbicide treatment would use a combination of picloram, commonly known by the trade name Tordon, and 2,4-D (Amine 4). Picloram would be applied at about 2 quarts per acre (0.12 gallons per acre of active ingredient); 2,4-D would be applied at 3 pints per acre (0.18 gallons per acre of active ingredient).

    - Picloram is a restricted-use herbicide (used only by certified applicators) that acts on broadleaf plants as a growth regulator. Picloram is fairly persistent in soil due to its slow degradation by soil microorganisms and ultraviolet light. Because of its persistence, picloram would provide an effective 2- to 3-year control of spotted knapweed in the project area.

    - 2,4-D is not a restricted herbicide and is used in products marketed for home use. It acts on broadleaf plants as a growth regulator. 2,4-D is less persistent than picloram. Soil microorganisms break it down in a matter of weeks. For this reason, it is safer to use closer to surface water, but is less effective than picloram in controlling targeted noxious weeds.

Human health risks associated with herbicides used for noxious weed control have been documented in Analysis of Human Health Risks of USDA Forest Service Use of Herbicides to Control Noxious Weeds in the Northern Region (Monnig, 1986). The report concluded that even when considering mixing errors and a variety of accident scenarios (spills, leaks, etc.) the "No Observable Effects Levels" (NOEL) for human health are not exceeded.

Picloram and 2,4-D are specifically analyzed for human toxicology in a USDA Forest Service EIS "Noxious Weed Management on the Lolo National Forest" (Lolo, 1989). The EIS summarized studies that show these herbicides do not bioaccumulate or biomagnify. Animals high on the food chain (humans, eagles, wolves) are not expected to acquire concentrated doses of these chemicals by feeding on contaminated plants or animals. Carcinogenic studies indicate risk levels are low to nonexistent.

The targeted noxious weeds are considered generally unpalatable to wildlife, but may provide for some forage. Seeding following herbicide application is designed to replace weeds with more palatable grasses. Existing established grasses along treated roads would not be affected.

Wildlife could receive doses of herbicide by eating contaminated food either through the direct consumption of herbicide-treated vegetation or indirect consumption, such as a lion feeding on elk that has consumed herbicide-treated grass. Also, wildlife (birds, squirrels, etc.) may be sprayed by herbicide during application. The USDA Forest Service EIS "Noxious Weed Management on the Lolo National Forest" (Lolo, 1989) discusses indepth toxicology for wildlife species that would typically frequent treated areas. The conclusion of the EIS is that both herbicides are considered nontoxic if applied at recommended label doses.

Herbicide spills could put wildlife at risk. Every precaution would be taken to avoid any spillage. A spill could result in concentrations hundreds of times greater than that occurring in treated areas. Certified applicators would be required to treat these areas as toxic waste spills even if labeled nontoxic. Human activity would likely preclude wildlife from entering the spill area until it is cleaned up. In the unlikely event a spill occurs, the impacted areas should be small and short term.

Herbicides pose a potential risk to aquatic and fisheries resources if misapplied. Impacts could occur from herbicides entering streams, lakes, or wet lands via aerial drift, runoff after storm events, or accidental spills. Picloram and 2,4-D can be toxic to some fish and invertebrates depending on species sensitivity and herbicide formulation. These herbicides can be toxic to some aquatic flora and may be detrimental to some sensitive species if they enter surface water.

To reduce the risk to aquatic and terrestrial resources, herbicide application would adhere to Montana BMPs and the herbicide's specific label guidelines. Herbicide application would not be general, but site specific to areas along roads where noxious weeds are occurring. Application would occur on calm, dry days to limit drift and possible surface movement off road prisms. Because of its persistence, picloram would not be applied within 50 feet of surface water. Because of its ability to break down quickly, 2,4-D would be used in areas 25 to 50 feet from surface water. No herbicides would be applied within 25 feet of surface water or to areas where relief may contribute runoff directly into surface water. All no-spray areas will be designated on the ground before application begins. Herbicides would be applied when they are most effective, May and June, when plants are actively growing, or in late summer, the end of August and September.

SOIL

EFFECTS OF ALTERNATIVE A

With the No-Action Alternative, there would be some continued effects to soil resources by erosion on open and closed roads that have inadequate surface drainage and erosion-control features. These situations would continue to improve or degrade as dictated by natural or preexisting conditions. The concentration of water that contributed to the debris-flow slope failure in Section 30 of the project area would not be repaired to meet current BMP standards under the current proposal and would continue to erode. Water would continue to be concentrated above this failure, as dictated by existing conditions, until another source of funding becomes available to remedy it.

EFFECTS OF ALTERNATIVES B, C, D, AND E

Ground-based timber-harvesting activities have the potential to rut, compact, and displace soil. These impacts can lead to difficulty in timber regeneration, loss of soil productivity, and erosion. Susceptibility to these impacts is affected primarily by soil type, slope, and harvest method (see Soil Map and Chart, Appendix B). For each of the timber-harvesting alternatives, precautions would be taken to reduce soils impacts from skidding and mechanical site preparation (See Stipulations and Specifications, Appendix A). The area of soils affected by the proposed alternatives would be limited to less than 15% of the harvest units to maintain long-term soil productivity (see Table IV-12). These alternatives would include the addition of surface drainage and erosion-control features on the existing road system. These improvements would decrease the surface erosion on the roads and disperse concentrated road runoff, which contributed to the existing debris-flow slope failure in Section 30 of the project area.

Helicopter and cable yarding of timber would have negligible effects on soil productivity and erosivity, assuming that slash will be left on site for nutrient cycling. Landings for helicopters would be larger than those typically used for ground-based yarding, but landings would be more widely spaced than with conventional yarding methods and located on moderate, sloping, well-drained sites.

Ground-based skidding with rubber-tired skidders, tractors, or clippers are the most economical methods of timber harvesting on well-drained soils of moderate slope. Skidders and tractors, depending on the area of disturbance, have a higher risk of affecting soils through displacement and compaction. Main skid trails can become compacted and the long-term productivity of the site reduced unless remediated.

Soft-track skidders, specialized tractors that cause less displacement and compaction than the conventional ground-based yarding equipment, can be used on the steeper slopes and more sensitive soils where rubber-tired skidders, tractors, or clippers cannot operate.

Slash-disposal and site-preparation operations would incorporate a combination of broadcast burning and excavator piling. Site preparation in units yarded with a helicopter or cable system would be completed with broadcast burning. This burning would produce no displacement or compaction, and would have a short-term benefit to soil productivity and improve regeneration of trees. On suitable slopes, trackhoe excavators would be used to pile brush and scarify soil. Impacts of brush piling by trackhoe excavator are displayed in Table IV-12. Excavator piling and scarification would be limited to the area needed to accomplish silvicultural objectives. Woody debris would be retained to promote long-term soil stability and productivity.

EFFECTS OF ALTERNATIVE F

The effects of Alternative F would be similar to those discussed for Alternative A. Under Alternative F, timber harvesting would be deferred until a larger analysis area of the North Fork drainage has been assessed and its natural-resource values compared with those resource values found on Coal Creek State Forest. This alternative would include the addition of surface- drainage and erosion- control features on the existing road system, as described above.

TABLE IV-12 - SUMMARY OF EFFECTS OF PROPOSED ALTERNATIVES ON SOILS

Alternative	Acres of Harvest	Acres of Helicopter or Cable Yarding	Acres of Tractor Yarding[1]	Acres Trafficked by Skid Trails[2]	Acres of Ground-Based Site Preparation	Maximum Acres of Soil Impacted[3]	Percent of Harvest Unit Soils Impacted
A	0	0	0	0	0	0	0
B	931	386	545	109	165	36	4
C	1,226	435	791	158	411	78	6
D	699	154	545	109	165	36	5
E	994	203	791	158	411	78	8
F	0	0	0	0	0	0	0

[1] This includes both conventional ground-based equipment and low-pressure yarding equipment.
[2] 15-20% of ground-based harvest units.
[3] 7.5-10% of skid trails and less than 15% of the excavator-piled area.

CUMULATIVE EFFECTS TO SOILS

Cumulative effects to soils are a concern due to the ground-based skidding of trees. Many of the slopes suitable for tractor harvesting have been previously entered. Some of these areas would be used in each of the timber-harvesting alternatives, primarily in the stands south of Coal Creek. These old harvest units would have timber skidded through them using low-pressure, soft-track skidders. In each case, existing skid trails would be used to avoid cumulative impacts to the soils. New skid trails would be made in these units only if existing trails are located in undesirable locations that do not meet BMPs. Cumulative effects would be controlled by limiting the area of soil impacts with the skidding and slash-disposal mitigation measures listed below. Future stand entries would likely use existing roads, trails, and landings and, therefore, present a low risk of cumulative effects.

MITIGATION MEASURES COMMON TO ALL TIMBER-HARVESTING ALTERNATIVES

The following is a summary of mitigation measures that would be implemented to comply with BMPs and maintain long-term soil productivity. Cable and/or helicopter harvesting would be used on the steeper slopes and would have minimal impact to soils.

- Mechanical harvesting operations would be conducted when soils are adequately dry, frozen, or snow covered to minimize rutting and displacement.
- Ground-based (tractor) harvesting would be limited to slopes that are less than 40%. Soft-track yarders, suitable on slopes up to 55%, cause less effect than conventional tractor skidding and would be used to reduce the degree of soil impact. Skid trails would not cover more than 20% of the surface in any cutting unit.
- The contractor and sale administrator would agree to a general skidding plan prior to equipment operations. Ground skidding would be limited to slopes less than 45%, unless soft-track yarders are used.
- For long-term soil productivity, displacement and limited scarification would be required for silvicultural needs on 30% to 40% of areas treated in Coal Creek State Forest. Ten to fifteen tons of large woody debris would be left for nutrient cycling and maintenance of long-term soil productivity.

Adverse effects to soils would be minimized if these conditions, all applicable Best Management Practices, and the recommendations of the hydrologist are followed.

Impacts to soil productivity from any timber-harvesting alternative are estimated not to exceed 15% of the harvested acres, including skid trails and landings.

NATURAL AREA

NATURAL-AREA DESIGNATION

Cyclone Basin is the area within Coal Creek State Forest most often-cited as worthy of consideration as a possible Natural Area. None of the alternatives propose any activity within the Cyclone Basin proper, although some propose timber harvesting on nearby Winona Ridge. Effects on a possible future Natural-Area designation are thus primarily indirect and not amenable to quantitative analysis.

ALTERNATIVE A

Under Alternative A, no timber harvesting or mechanized activity would take place during the decision time period. Vegetation would remain similar to that seen today, except that a few trees would die and existing trees would grow slightly. The general trend toward dominance by shade-tolerant species would continue. The area most often cited as worthy of consideration as a Natural Area (Cyclone Basin) consists largely of habitat types on which soils are moist and fires infrequent; thus, dominance by shade-tolerant species is largely consistent with natural processes. The risk of a stand-replacing fire would remain essentially unchanged. A stand-replacing fire in Cyclone Basin would also be consistent with natural processes, and, thus, would not automatically exclude the area from further consideration as a Natural Area. However, an area of burned snags may be less attractive to potential funders, who would be needed to compensate the Trust.

No roads in or around Cyclone Basin would be gated or otherwise obstructed; thus, public use of the area would probably continue as currently or increase slightly. Additional analyses of DNRC management options in Coal Creek State Forest would continue, although they would not be provided special priority, nor would they consider non-DNRC ownerships within the North Fork. The potential for future natural-area designation would thus remain largely unchanged from its current status. There is little likelihood that selecting Alternative A would preclude a future Natural Area in Cyclone Basin. Similarly, there are few forces currently enhancing the potential for such designation. Thus, it is likely that, under Alternative A, the natural-area concept would remain in its current nebulous state, neither having been rejected nor advanced with seriousness and vigor.

ALTERNATIVES B AND C

Alternatives B and C both involve timber harvesting on South Coal Ridge, albeit with differing intensities and objectives. It is unlikely that any future Natural Area proposal would include this entire ridge, although it is possible that a small portion of the slope near the western boundary of Coal Creek State Forest would be considered due to its extremely large trees and diverse understory. Harvest unit boundaries under both Alternatives B and C avoid this small portion, although there remains a small risk that harvesting activity near it would lessen its biological uniqueness or its attractiveness to potential funders.

Alternatives B and C would also harvest timber on the western slope of Winona Ridge immediately south of Cyclone Basin, albeit with differing intensities and objectives. No new roads would be built to access this timber, and both prescriptions involve dispersed, partial cutting, thus preserving a "largely natural" appearance. However, timber harvesting would most likely not succeed entirely in emulating the appearance of a natural disturbance on Winona Ridge. Helicopter forwarding would create a temporary disturbance in the area, although we would expect no long-term negative consequences from this mechanized activity. Although unquantifiable, we conclude that selection of either Alternatives B or C would reduce slightly the potential for a future natural-area designation in or around Cyclone Basin, or at least reduce the geographic scope of such a designation to the Basin proper.

Other harvest units included within Alternatives B and C would be unlikely to affect the possibility of a future natural-area designation.

As under Alternative A, additional analyses of DNRC management options in Coal Creek State Forest would continue, although they would not be provided special priority, nor would they consider non-DNRC ownerships within the North Fork. There are few forces currently enhancing the potential for such designation.

ALTERNATIVES D AND E

As in Alternatives B and C, timber would be harvested on South Coal Ridge under both Alternatives D and E. Effects on the possible future designation of old-growth stands there as a Natural Area are the same as under Alternatives B and C. Other harvest units included within Alternatives D and E would be unlikely to affect the possibility of a future natural-area designation.

Unlike Alternatives B and C, Alternatives D and E would leave the western slope of Winona Ridge in its current condition. Because the Winona Ridge harvest units are the closest to Cyclone Basin (the most often-cited area for natural-area consideration), we conclude that Alternatives D and E would be unlikely to preclude any natural-area proposal for the Cyclone Basin area.

As in Alternative A, additional analyses of DNRC management options in Coal Creek State Forest would continue, although they would not be provided special priority, nor would they consider non-DNRC ownerships within the North Fork. The potential for future natural-area designation would thus remain largely unchanged from its current status. Thus, it is likely that, under Alternative D or E, the natural-area concept would remain in its current nebulous state, neither having been rejected nor advanced with seriousness and vigor.

ALTERNATIVE F

Alternative F would defer all harvesting in Coal Creek State Forest for a period of 2 years, pending completion of a spatially-explicit futuring exercise, including consideration of potentials and limitations beyond the Coal Creek State Forest borders. (Such futuring would involve computer-modeling of the forest, making varying assumptions about the locations and types of future harvests.) Thus, in common with Alternatives A, D, and E, it would do nothing to preclude future designation of a Natural Area.

Analyses conducted under Alternative F may conclude that designation of a Natural Area in Cyclone Basin (or any other area of Coal Creek State Forest) would not be a cost-effective use of private funds, given expected management under DNRC's mandate and programmatic plan. If this were to be the outcome, selection of Alternative F would ultimately resolve the current uncertainty about a Natural Area, but would do so by a decision not to designate one. Alternatively, such analyses may conclude that designation of a Natural Area in Cyclone Basin (or elsewhere) is desirable and affordable. If this were to be the outcome, selection of Alternative F would provide, by far, the highest probability of such a designation. However, in either case, selection of Alternative F would not, by itself, solve the natural-area question. It would, however, provide additional resources to address the potentials and limitations, and, thus, move all parties closer to a resolution.

WILDLIFE

COARSE-FILTER ASSESSMENT

Wild animals respond to a wide array of habitat features, integrated into what is termed a "niche". The predominant species of overstory tree is only one of these features. However, to the degree that the current distribution of cover types diverges from that which more typically has characterized the Coal Creek State Forest during the time these species have occupied the area, and as gene frequencies have been selected for which optimize local adaptations, current conditions could be viewed as less than optimal. Therefore, modification of forest types in directions that more nearly resemble those present historically would be positive.

Although it is appropriate to focus attention on areas that will be modified by timber harvesting, it is also worth noting that selected portions of Coal Creek State Forest were considered for timber harvesting, but rejected because keeping them in their current condition was deemed important for reasons of ecosystem integrity and/or landscape heterogeneity. Worth noting are the following patches, which would change only very slowly during the next few years regardless of whether an action alternative is selected or not, and if one is, which one:

In Alternatives B and D, the upper slopes of the ridge south of Coal Creek, including all of Section 31, the southern portion of Section 30, and

approximately the southern 7/8 of Sections 32 and 33, all of which have high values as a large, relatively homogenous old stand and provide the most-consistently highly-rated grizzly bear habitat on Coal Creek State Forest (Appendix C);
all of the stands surrounding Cyclone Lake, where a number of sensitive resources are located;
stands in Section 15, northeast of Cyclone Lake (often referred to as the "saddle" or "notch" between Winona Ridge and Winona Peak), which likely function as an important wildlife travelway, providing uninterrupted closed-canopy forest between Cyclone Basin and the North Fork of the Flathead River drainage; and
mesic stands in Section 10 (just north of the "saddle") between existing older harvest units, which were similarly considered important for wildlife cover and connectivity.

COVER-TYPE CHARACTERISTICS: EFFECTS ON WILDLIFE

Effects on the entire faunal assemblage of changes in cover types therefore would mirror those assessed in the vegetation section (c.f.). Not all species would necessarily benefit by increasing the abundance of currently underrepresented cover types and decreasing those that have increased due to lack of fire. Some species have benefited from the general trend toward a predominance of shade-tolerant overstory trees, and would continue to do so under Alternatives A and F. However, the coarse-filter assessment accepts that individual species vary in their requirements and, therefore, focuses on the general trends for the entire faunal assemblage.

Species that thrive where Englemann spruce and subalpine fir dominate the overstory would benefit from Alternatives A and F. Conversely, those species for which western larch performs functions that cannot be duplicated by other species would continue to be less abundant under these alternatives than they could be.

The remaining action alternatives are broadly similar in their effects on cover type conversions. Species for which Englemann spruce and/or subalpine fir perform important functions would be negatively affected, with habitat reductions roughly following the proportional reduction in acreage of mixed-conifer cover types. Species for which western larch performs critical services would benefit from the action alternatives, although the time period at which this benefit would occur would vary, depending on the species preference for size, age, and structure (see section on Stand Age Characteristics).

These broad patterns in cover types are also reflected in the remainder of the Whitefish Range and portions of the North Fork of the Flathead River valley managed by FNF. Lacking fire, the trend of slow conversion toward shade-tolerant trees will likely continue on the surrounding lands as well. Cumulatively, these trends would tend to be detrimental to species adapted to forests dominated by shade-intolerant trees should no management activities replace fires in their effect. Conversely, if an action alternative were chosen, its effects would be cumulative to any similar timber-harvesting activities that occurred outside Coal Creek State Forest on FNF.

STAND AGE CHARACTERISTICS: EFFECTS ON WILDLIFE

The vegetation analysis has shown that, currently, stand ages in Coal Creek State Forest are broadly similar to historical patterns. The most prominent divergences from historical averages occur in the western larch/Douglas-fir cover type (where old growth is underrepresented relative to historical averages), and lodgepole pine stands (where mid-aged stands are overrepresented relative to historical averages). The remaining cover types currently have a distribution of ages that does not substantially differ from the mosaic of ages that probably typified the Coal Creek State Forest area prior to effective fire suppression.

Under Alternatives A and F, all stands would continue to age gradually (barring an uncontrolled fire). This would benefit species for which increased structure, large snags, large down woody material, and decayed live trees form an important habitat component. This condition would negatively affect species that are adapted to postdisturbance forests.

The conversion of approximately 150 acres of mid-aged lodgepole pine to a young lodgepole stand, common to all action alternatives, would generally move the size/age distribution of lodgepole stands closer to historical conditions. This would generally benefit species adapted to a dense, young, vigorously growing stand of young lodgepole (and probably Englemann spruce), particularly prior to thinning. If thinning were to occur, some of these benefits would be lost, because the most likely natural disturbance in such a stand would remove all the stems, rather than simply thin them.

The removal of older, mixed-conifer stands, as envisioned in Units 2 and 5 under Alternatives B and D, would generally move the distribution of stand ages in a way that is ambiguous with regard to historical patterns. The acreage of older mixed-conifer stands would remain near historic levels (Table III-4), but the acreage of young western larch/Douglas-fir stands – already in healthy supply on the Coal Creek State Forest – would increase further. Species adapted to older forest stands would be affected negatively by reductions in old forests in this alternative, although close-to-historical amounts would remain post-harvest. The negative effects would be lessened, although not completely ameliorated, under the harvesting in Units 2 and 5 proposed under Alternatives C and E. Most of the large, shade-intolerant canopy dominants and emergents would remain under these alternatives, but habitat characteristics produced by the mid-story of shade-tolerant species would be removed.

Activities in Unit 1 (on Winona Ridge) under Alternatives B and D would remove many of the dead and dying mature Douglas-fir trees. A multiaged structure would remain, as assessed over the entire unit. This multiaged structure occurs naturally on the site because root rot has been active for many years. New openings, 0.5 to 10 acres in size, would be created. Species that can make use of the large-sized, dead and dying Douglas-fir would therefore be negatively affected. The accumulation of large, coarse woody debris in these areas would slow from its current pace. Species that benefit from small openings and increased edge would benefit. Under Alternative B, ponderosa pine would be planted and be expected to resist the endemic root rot. This would alter the naturally-occurring open structure on affected portions of Winona Ridge because pine would be able to take advantage of places currently lethal to Douglas-fir. Species that benefit from the presence of ponderosa pine, however, would benefit. Ponderosa pine is not currently present on the site, although it appears capable of successful growth and reproduction there.

Reductions in the acreage of older forests on Coal Creek State Forest, although minor and evidently resulting in proportions that are within historical norms, would be cumulative to prior reductions that have occurred in the North Fork drainage outside of Coal Creek State Forest. FNF has recently concluded that older forests stands on FNF lands in the North Fork are currently below the range of naturally occurring variation, and they are seriously considering management strategies that would prioritize increasing the abundance of old-growth (USFS 1997).

PATCH CHARACTERISTICS: EFFECTS ON WILDLIFE

Under Alternatives A and F, patch configuration would remain essentially static. Patch size and shape has been shown in simulation models to change very slowly, and this will be especially so without additional disturbance. Patch size is currently lower than historically characterized for Coal Creek State Forest, particularly among older stands where interior conditions can be important to some species.

Alternatives B and D were designed, in part, to increase the size and reduce the existing harsh edge between old and young stands in the region south of Coal Creek. This benefit would be realized, although interior conditions in old growth would take many decades to develop. However, the sum total of cuts in Alternatives B and D is not as successful in increasing patch size as had been hoped, particularly when describing patches based on stand age: Only in the youngest age class would mean patch size increase. Patch size would increase among lodgepole pine and western larch/Douglas-fir cover types, but not others.

These general patterns are also seen under Alternatives C and E, although the effects are much less noticeable, particularly among current old growth.

Lacking documentation of patch characteristics for lands outside of Coal Creek State Forest, it is not possible to conduct a quantitative cumulative-effects assessment of this forest attribute. It is probable that the same basic patterns hold both on and off Coal Creek State Forest within the North Fork area.

SPECIAL HABITATS

Under Alternatives A and F, the special habitats recognized in Chapter III would remain essentially unchanged. If Alternative F was chosen, and it led ultimately to the designation of a Natural Area, these 3 areas would be likely be among those considered for inclusion. Harvest units planned under Alternatives B through E similarly avoid these 3 areas and leave buffers where they come close to them. Therefore, we expect no substantial modifications to these areas under any alternative.

FINE-FILTER ASSESSMENT

THREATENED AND ENDANGERED SPECIES

Peregrine Falcon *(Falco peregrinus)*

Because peregrine falcons are not known to nest in, or depend on, Coal Creek State Forest for living requirements, and because potential nesting habitat appears to be limited on Coal Creek State Forest, no direct effects on this species from any alternative is expected. Migratory peregrine falcons may, however, use Coal Creek State Forest, near Winona Ridge in particular. Alternatives B and D include timber harvesting and helicopter yarding on the western slopes of Winona Ridge, activities that could disturb migrating peregrine falcons. It is unknown what effects temporarily disturbing a normal migration route might have on individual peregrine falcons. Such a disturbance is not specifically mentioned as a concern in either USFWS (1984) or USFWS (1992). We believe that individual peregrine falcons would be able to modify their activities to accommodate such disturbance without negatively affecting productivity or survival. Thus, any impacts on individual peregrines would be temporary and minor, and there would be no effect on peregrine populations.

Bald Eagle *(Haliaeetus leucocephalus)*

Under Alternatives A and F, we would expect no substantial changes in the capability of the Cyclone Lake area to support nesting bald eagles. Habitat conditions would remain essentially static in the short term, and even longer-term changes would be minor. (Because most of the lake vicinity is characterized by long fire-return intervals, continued absence of fire for a few more decades is unlikely to lead to substantial changes in forest structure or composition). Recreational levels and trends remain largely undocumented. They are probably largely similar to those reported in McFadzen (1992), but given the general increase in human population and recreational activity in the North Fork in general, would probably continue to increase slowly. As noted in Chapter III, snowmobiling on Cyclone Lake has recently become more popular, and, when occurring late in the winter, may constitute a disturbance to nesting eagles. We would expect this to continue unchanged, or increase slightly with time, under Alternatives A and F.

As indicated in the section on a possible Natural Area, Alternative F would generally increase the potential for a Natural Area to be designated at some future time. If a Natural Area was to be designated, whether or not eagles would benefit directly would depend on management plans and implementation funding available at the time.

None of the action alternatives considered involve timber harvesting or mechanized activity in either the Nest Site Area, Primary Use Area, or Potential Nesting Habitat zones identified by McFadzen (1992).

All alternatives include a new seasonal closure (using a gate) of the road leading to Cyclone Lake from November 15 until 1 July of each year (see Figure IV-15 segment D). This is intended to reduce traffic to, and use of, Cyclone Lake during the early portion of the nesting season. If such a closure were effective, reducing human presence on or near the lake at this time of year would be beneficial to nesting eagles.

All alternatives also include gating the entrance to a trail from Road 4-A to the northeast shore of

Cyclone Lake (this trail was cut illegally by unknown persons in 1996), as well as the posting informative signs on Road 4-A indicating that Road 4-A is administratively closed. We suspect that the newly cut trail is used during winter to gain snowmobile access to Cyclone Lake, and that existing gates on Road 4-A that access this trail are incapable of preventing snowmobile access. These action alternatives include no specific law-enforcement activities (which are generally considered to be the responsibility of DFWP), but placing informative signs and an additional gate to prevent access to the illegally cut trail may help decrease unlawful use of the lake during this sensitive portion of the eagle-nesting sequence. If the additional road closure actions (described above) were effective in reducing human use during late winter/early spring, we would expect Alternatives A and F to produce a net benefit to nesting bald eagles.

Alternatives B and C include harvesting timber (of differing amounts) on the west slope of Winona Ridge, above the Cyclone Lake outlet (Unit 1 in both alternatives). In both cases, all transporting of logs would be via helicopter; no roads would be built. Helicopter flight paths are not yet known with precision, but would almost certainly cross a subsidiary, but possibly important, bald eagle flight path (McFadzen 1992:14). It is unlikely that forest stands affected by harvesting proposals in Alternatives B and C are used directly by bald eagles. However, it is possible that disturbance associated with either the cutting on Winona Ridge, helicopter transporting of logs across the outlet below Cyclone Lake, or both, could constitute a detrimental effect to nesting bald eagles. In recognition of this possibility, timing restrictions on helicopter flights over the Cyclone Lake outlet would be included in any timber sale contract. No helicopter flights would be allowed before August 1, unless the nest was documented as having failed earlier in that year. These timing restrictions are intended to avoid disturbing nesting eagles during the early portion of their nesting sequence when eagles are generally considered most sensitive to disturbance (MBEMP 1994:22). Such restrictions would reduce considerably, but not entirely, the risk that nesting bald eagles would be adversely affected by this mechanized activity. Thus, Alternatives B and C include a small, albeit unquantifiable, risk of additional disturbance to the nesting bald eagles during the latter portion of their nesting sequence.

If the additional road closure actions (described above) were effective in reducing human use during late winter/early spring, they would benefit bald eagles by reducing disturbance during the early portion of their nesting sequence. Without knowing the ultimate effectiveness of the road closures, the level of disturbance created by the helicopter flights, and specific reactions these particular eagles may have to either, it is difficult to assess the net effect of the two offsetting actions.

Alternatives D and E do not include harvesting on the west slope of Winona Ridge (Unit 1 in Alternatives B and C), and thus do not pose any risk of additional disturbance to nesting bald eagles. If the additional road-closure actions (described above) were effective in reducing human use during late winter/early spring, we would expect Alternatives D and E to produce a net benefit to nesting bald eagles.

Wolf *(Canis lupus)*

The principal measure proposed to mitigate adverse effects of mechanized disturbance on wolves is a temporary cessation of all activity within a 1-mile radius of any known active wolf den or a 0.5-mile radius of any known active rendezvous site. This mitigation measure would be included in the contract language should any of the action alternatives be selected (see Stipulations and Specifications, Appendix A). Wolves may be sensitive to human disturbance at these areas, but they otherwise appear capable of continuing their recolonization of the North Fork of the Flathead River area under land management similar to that proposed under any alternative.

DNRC biologists and managers are aware of wolf-denning activity in close proximity to Coal Creek State Forest during 1997 and will continue to stay in close contact with personnel from the USFWS and USFS regarding future activities of this pack as long as necessary. Should den or rendezvous sites be located near proposed activities, contract administrators will suspend operations until DNRC biologists determine that disturbance is no longer likely.

We do not anticipate substantive changes in numbers, distribution, or habitat-use patterns of large ungulates, the wolf's principal prey, under any alternative.

Thus, we expect disturbance to wolves neither directly nor indirectly through adverse effects on their principal prey species. Road access to areas potentially used by wolves would parallel that projected in the section (below) on grizzly bears: We project that public access under action alternatives would decrease slightly during the spring period because of additional seasonal road closures. This would have a small, positive effect on wolf-survival probability.

In sum, we expect no discernible effects on wolves from any alternative and believe that all alternatives would thus effect wolves similarly.

Grizzly Bear *(Ursus arctos)*

As in the assessment of the current condition (Chapter III), we focus our analyses on indices of human disturbance to grizzly bears, for which we use roads as reliable surrogates. We use 3 specific indices:

1) PTR - percent of the landscape controlled by DNRC that a moving-windows analysis calculates as being more than 2 miles per square mile total road density;

2) POR - percent of the landscape controlled by DNRC that a moving-windows analysis calculates as being more than 1 mile per square mile open road density; and

3) A quantitative assessment of habitat quality affected by open roads using the modeled habitat map of R. D. Mace and assuming a buffer distance of 0.5 kilometers (approximately 0.3 mile) for each road.

In addition, we examine hiding cover to further assess possible displacement and/or mortality risk to grizzlies from human activities associated with the action alternatives.

Road Densities

Total road density (PTR)

Only 1 small segment of new road, a short one-half mile long spur road in the northeastern portion of Section 14, is contemplated under any of the action alternatives. However, because this segment is located in an area that already contains more than 2 miles per square mile total road density, there would be no increase in the proportion of the area exceeding the total road density threshold (PTR) if it were built. Additionally, if this spur were built, the switchback road in the center of Section 11 would be reclaimed. However, this road is also located in an area that already contains more than 2 miles per square mile total road density. Therefore, there would similarly be no decrease in PTR if it were reclaimed.

Thus, because of the location of both road segments that might be added or reclaimed as part of any of the action alternatives near existing roads, there would be no change in PTR under any of the alternatives under consideration. Internal guidance calls for DNRC to maintain no net increase in PTR from current conditions.

Because there would be no change in PTR caused by this project, there are no cumulative effects in PTR to consider.

Open-road density (POR)

Most of the roads within Coal Creek State Forest are currently gated, restricted to public motorized access, and subject to motorized administrative access of less than 6 trips/week. These, therefore, are not categorized as "open" roads. However, should an action alternative be selected, some roads currently categorized as restricted (i.e., "nonopen") would change to the "open" status due to the increase in administrative and commercial motorized use (Figures IV-13 and IV-14). All action alternatives require use of the existing (restricted) road system in Section 14; however, there are 2 alternative access routes:

1) via the existing road originating to the north of Section 14, in Section 4 at the USFS boundary, and

Figure IV-13
Cyclone/Coal Timber Harvest Project
Road "Open Scenario" Map

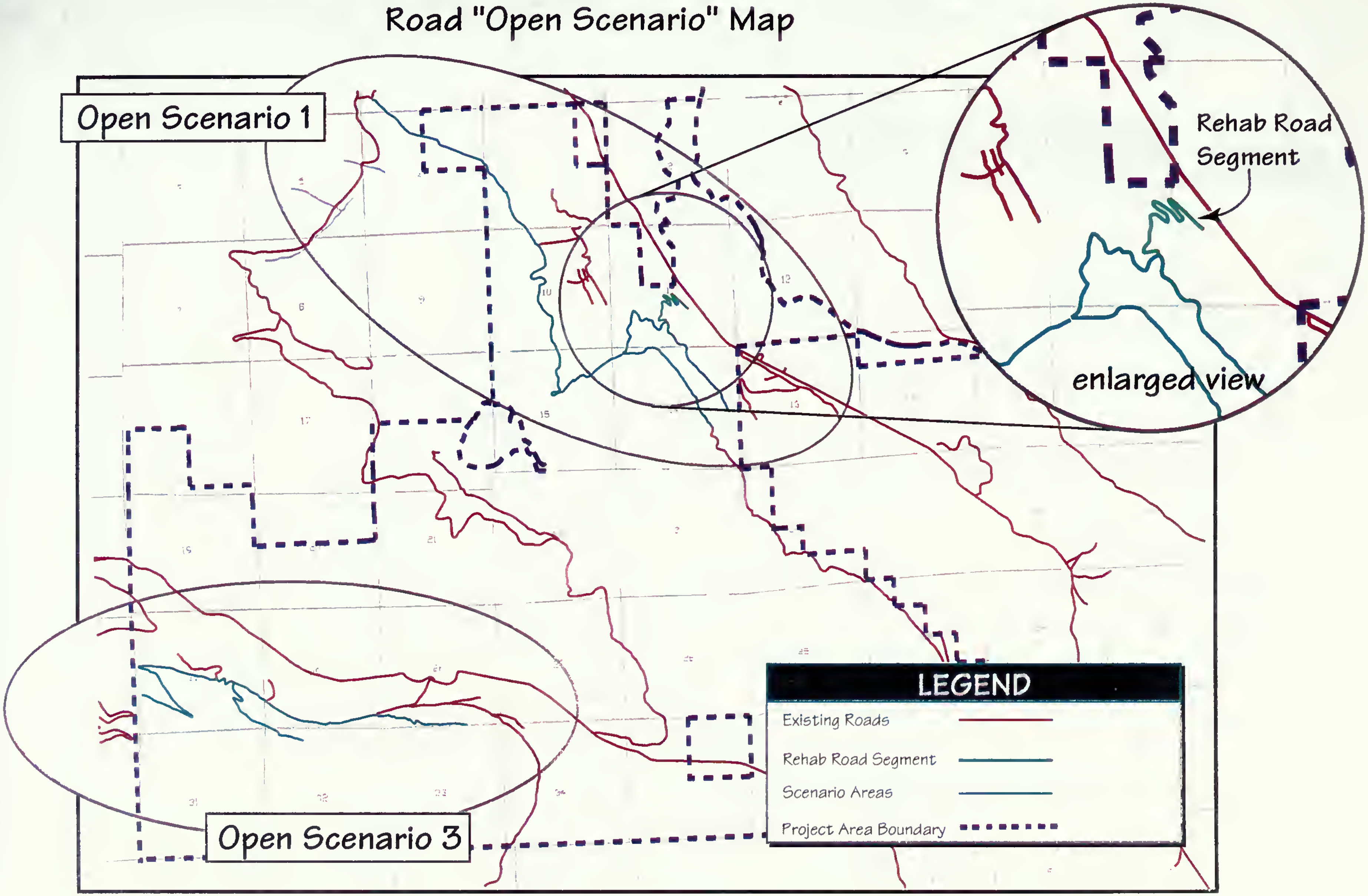


Figure IV-14
Cyclone/Coal Timber Harvest Project
Road "Open Scenario" Map

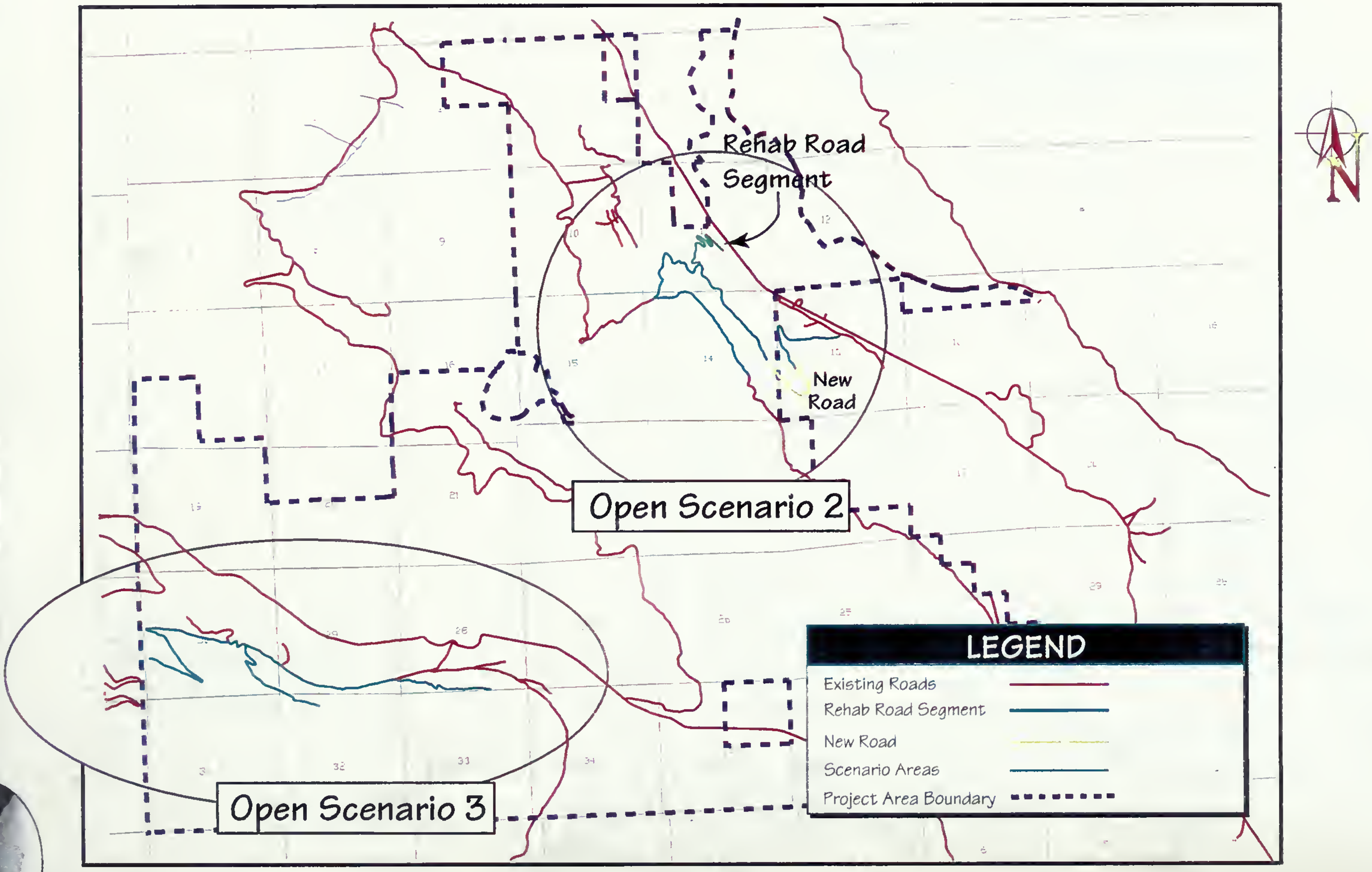
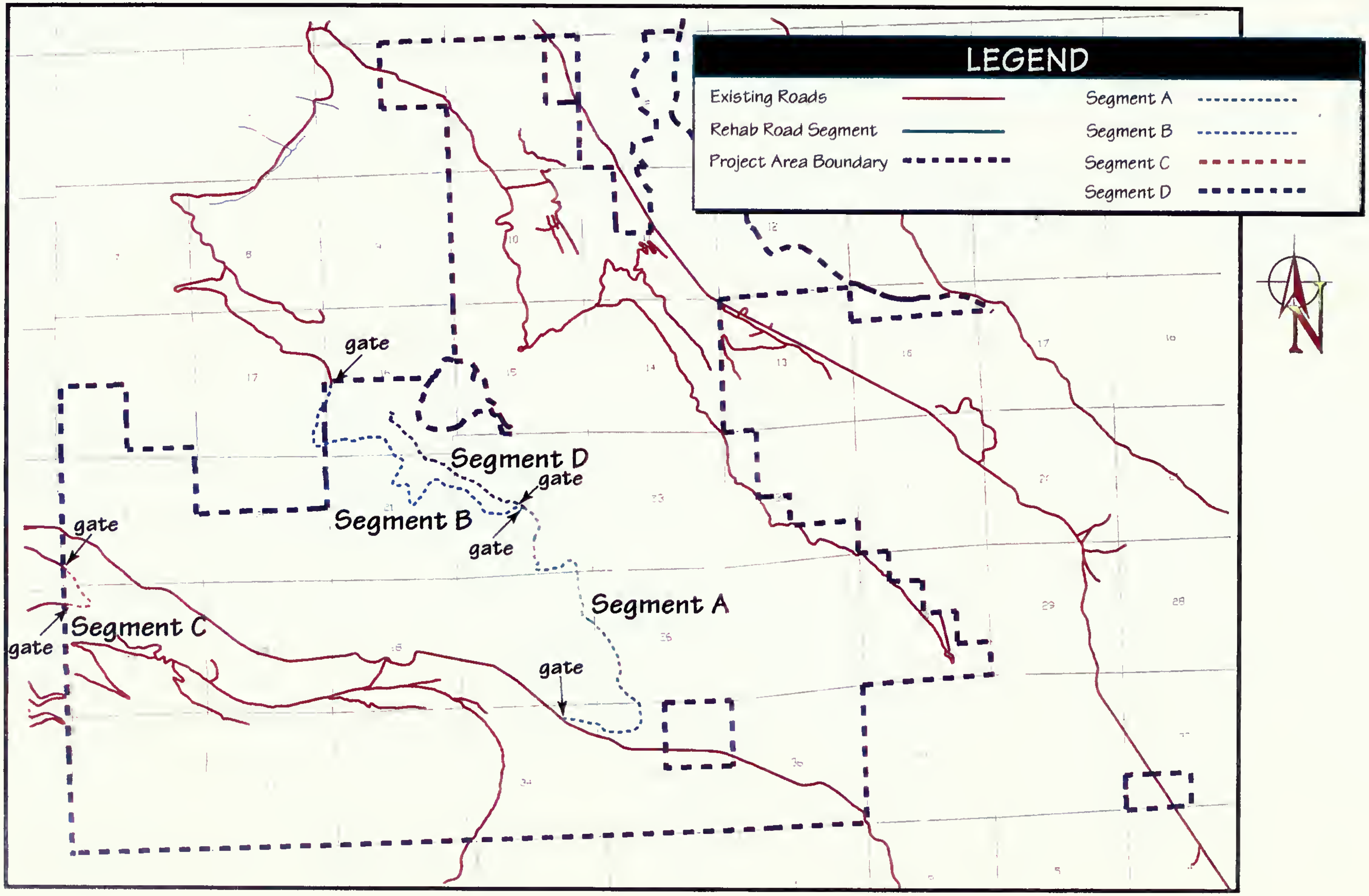


Figure IV-15
Cyclone/Coal Timber Harvest Project
Road "Segment Closure" Map



2) via a short spur road to be built from the existing private road system in Section 13 (see above section on PTR).

Use of the existing access road in Section 11 (the "switchback" road) is not being considered under any of the alternatives, and would thus retain its "restricted" status.

All action alternatives also require use of the existing (restricted) road system in the South Coal area (originating in Section 28).

For simplicity, these 3 potential access scenarios are referred to as Open-Road Scenarios 1, 2, and 3.

Scenario 1 - Access to Section 14 would occur via the existing restricted road that enters DNRC lands from the north (i.e., from the USFS road on Hay Creek). This road system would be reclassified as open during any year of activity in Section 14. During that year, no harvest activity would occur in the South Coal area, thus no currently restricted roads there would be reclassified as open.

Scenario 2 - Access to Section 14 would occur via a spur road to be built in Section 4; therefore existing restricted roads north of Section 14 would not require reclassification. As in Scenario 1, no harvest activity would occur in the South Coal area during any year that Section 14 was active.

Scenario 3 - would occur in any year in which the South Coal area is subject to mechanized activity; currently restricted roads in this area would receive enough motorized use to change their classification to open, but no currently restricted roads east of Winona Ridge (i.e., in or accessing Section 14) would need to be reclassified. Under no condition would mechanized activity in both Section 14 and South Coal occur during the same year.

New gates that could be closed during all or portions of each year are considered at 4 locations, allowing currently "open" roads to qualify as "restricted" (Figure IV-15). Closures 'A' and/or 'B' would cut off direct motorized access between the Coal and Hay creeks (because the connecting road through Cyclone Basin would no longer link the two), although indirect access would still exist through the North Fork Road. Closure 'D' would remove direct motorized access to Cyclone Lake. Closure 'C' would have little effect other than to stop public access approximately 0.5 mile lower than it is currently (at the USFS boundary). Unlike the Open Road Scenarios, these closures could be accomplished in any combination.

Table IV-13 summarizes proportional changes from the current POR (40.8%) of all DNRC lands within Coal Creek State Forest. Positive numbers indicate a net increase in the proportion of DNRC lands exceeding 1 mile per square mile open road density; negative numbers indicate a net decrease in that proportion. Internal guidance calls for DNRC to maintain no net-increase in POR from current conditions.

As can be seen from Table IV-13, Open-Road Scenario 1 requires the most "roadedness"; only by a combination of all of the closures considered can the goal of "no net increase" in POR be met. Open-Road Scenario 2 requires the least addition of open roads; combining closure 'D' (Fig. IV-15 with any additional closure results in no net increase in POR.) Open-Road Scenario #3 is similar in net effect to #2, but has slightly higher road densities. Closure 'A' is located on Cyclone Basin Road (FS Road 909), which leads from Coal Creek Road (FS 317) into Cyclone Basin. This closure produces the greatest net decrease in POR for all Open-Road Scenarios, followed by Closure B.

Table IV-13 applies only if closures are in effect at all times during any year (defined as nonwinter seasons). Some closures, either individually or in combination with others, might be judged as having undesirable effects on other resources (e.g., recreational, commercial), and, thus, might be instituted for only a portion of the year. Thus, for example, if closures 'AD' were instituted for the spring season, but those gates were opened to allow public access after July 1, POR would decrease by 8% and 3% under access Scenarios 2 and 3, respectively, during spring, but would increase by 12% and 15% during summer.

For grizzly bears, the preferred condition is for both PTR and POR to be as low as possible; thus, DNRC strives to maintain no net increase in either. Should an increase be considered unavoidable because of other resource concerns, the next best option is for increases to be small and temporary (i.e., not permanent alterations to the landscape). Because grizzly bears are able to exploit a larger variety of food resources during summer than during spring or autumn, they tend to be most tolerant of displacement during summer. Thus, if a net increase in PTR or POR were necessary during some season, it would be expected to have the least detrimental effect during summer. However, even if temporary and restricted to summer, an increase in POR, as would occur if road closures do not apply during summer, would be expected to reduce available habitat for grizzly bears by an amount roughly proportional to the increase.

Cumulative effects – POR

The POR has not yet been determined for each action alternative. The specific open-road scenario decision will be made as part of the ROD. As of this date, any combination of open-road scenarios displayed in Table IV-13 could apply to any of the action alternatives.

TABLE IV-13

Closures	OPEN-ROAD SCENARIOS		
	1 (Section 14 - Hay Ck.)	2 (Section 14 -Spur Rd.)	3 (South Coal)
None	32%	12%	15%
A	19%	-3%	2%
B	23%	1%	6%
C	30%	8%	15%
D	29%	8%	13%
AC	17%	-5%	2%
BC	20%	-1%	6%
DC	27%	5%	13%
AD	14%	-8%	-3%
BD	15%	-7%	-1%
ABD	2%	-20%	-15%
ABCD	0%	-22%	-15%

Habitat value influenced by motorized activity

Table IV-14 summarizes the relative effects on adjacent grizzly bear habitats of opening currently closed roads to motorized activities (to allow harvesting under the various action alternatives) and of closing currently open roads to the public or for administrative use. All indices in the table are additive.

Any of the indices (for a given season) can be combined to estimate a cumulative effect due to a combination of openings and closings. For example, if both Units 2 and 5 were to be open for harvesting simultaneously and no additional road closures were to occur, we estimate that habitats available for unencumbered use by grizzly bears on Coal Creek State Forest would be reduced by 35% to 47% during spring (the range in reductions reflecting 2 possible access routes for Unit 2).

Conversely, if neither Unit 2 nor Unit 5 were to be harvested, no opening of currently gated roads would be necessary, but if gates were to be added to all legally closeable open roads, we estimate that habitats available for unencumbered use by grizzly bears would increase by some 38% during spring [i.e., 1-0.86 for closure 'A', plus 1-0.94 for closure 'B', plus 1-0.93 for closure 'D', plus 1-0.89 for closure 'E'], 40% during summer, and 42% during autumn. Action alternatives would most likely involve some combination of new openings and gating currently open roads in any given year. Thus, for example, in a year in which only Unit 5 was accessed and closures 'A' and 'D' were implemented, the net result would be no change in the available value of spring grizzly bear habitat (1.21 - ([1-0.86]+[1-0.93])). In a year when Unit 2 was opened via access Scenario 2, and the only additional closure was that of 'B', we estimate a net loss of 14% value in spring grizzly bear habitat due to roads.

TABLE IV-14 - GRIZZLY BEAR ROAD VALUES

Seasonal indices of grizzly bear habitat affected by open-road systems under various road scenarios, relative to the existing condition (existing condition = 1.00). Raw values were computed by summing the habitat values of all 30-square-meter pixels within a 500-meter buffer from roads used by vehicles. These values, thus, are affected both by the total acreage within the buffer and by the magnitude of the seasonal values of each pixel involved. Indices more than 1.00 represent scenarios where more valuable habitat is affected by the open-road system than under the existing condition; indices less than 1.00 represent scenarios where less valuable habitat is affected by the open-road system than currently. Unlike analyses based on the moving-windows technique, all these indices are additive (i.e., one can sum various combinations of openings and closings to estimate a cumulative effect). **(Use Figure IV-15 with this table.)**

SCENARIO	SPRING	SUMMER	AUTUMN
(Current)	1.00	1.00	1.00
Opening Currently Gated Roads to Mechanized Equipment (habitat loss):			
Open-Road Scenario 1	1.26	1.25	1.24
Open-Road Scenario 2	1.09	1.08	1.08
Open-Road Scenario 3	1.21	1.23	1.23
Closing Currently Open Roads with Newly Installed Gates (habitat gain):			
Closure 'A'	0.86	0.86	0.86
Closure 'B'	0.94	0.92	0.91
Closure 'D'	0.93	0.93	0.92

Hiding Cover

Assuming that all proposed harvest methods reduce hiding cover to levels below that which would qualify as grizzly bear hiding cover (see Chapter III), at least in the short term, Alternatives A and F would leave hiding cover unchanged (although it would increase gradually). Alternative B would reduce the current 80% of Coal Creek State Forest that provides hiding cover for grizzly bears to approximately 74%, Alternative C to 72%, Alternative D to 75%, and Alternative E to 73%. Hiding cover would return in time, but it is beyond the scope of this analysis to predict that recovery because it depends on site-specific factors. DNRC internal guidance calls for retaining at least 40% in hiding cover. The importance of hiding cover is closely related to human access to the area: grizzly bears have less need of hiding cover when the area is secure from human access (i.e., no open roads, restricted roads effectively closed and used very little administratively). They have more need of hiding cover where humans can use the area. In general, hiding cover is less important to habitat effectiveness for grizzly bears than is POR or PTR.

SENSITIVE SPECIES: CONSIDERED THROUGHOUT THE ANALYSIS

The following sensitive species are considered to either occur on or near Coal Creek State Forest, or have habitats that are represented within Coal Creek State Forest. They are thus considered throughout the document.

Common Loon (*Gavia immer*)

Assessment of potential effects on common loons nesting on Cyclone Lake is generally similar to that for bald eagles. Under Alternatives A and F, we would expect no substantial changes in the capability of the Cyclone Lake area to support nesting loons. Recreational levels and trends remain largely undocumented. They are probably largely similar to those reported in McFadzen (1992), but given the general increase in human population and recreational activity in the North Fork area in general, they would probably continue to increase slowly. An increase in boating activity in Cyclone Lake without increased awareness of loons and their sensitive brood-rearing areas would be expected to increase the level of disturbance, and, potentially, negatively affect brood survival.

As indicated in the section on a possible Natural Area, Alternative F would generally increase the potential for a Natural Area to be designated at some future time. If a Natural Area was to be designated, whether or not loons would benefit directly would depend on management plans and implementation funding available at the time.

None of the action alternatives considered involves timber harvesting or mechanized activity in or near the usual sites for nesting or brood rearing (Skaar 1989, Dolan 1994). Thus, we expect no direct negative impacts on nesting loons from timber harvesting (but see below).

All alternatives include a new seasonal (closure using a gate) of the Cyclone Creek Road from November 15 through July 1 (see Figure IV-15 segment D). This is intended to reduce traffic to, and use of, Cyclone Lake during the early portion of the nesting season. If such a closure were effective, reducing human presence on or near the lake at this time of year would be beneficial to nesting loons.

All alternatives also include gating the entrance to a trail from Road 4-A to the northeast shore of Cyclone Lake; this trail was cut illegally by unknown persons in 1996. Also, informative signs would be posted on Road 4-A indicating that it is "Administratively Closed". We suspect that this newly cut trail is used during winter to gain snowmobile access to the Lake, and that existing gates on the Road 4-A that access this trail are incapable of preventing snowmobile access. These action alternatives include no specific law-enforcement activities (which are generally considered to be the responsibility of DFWP), but placing informative signs and an additional gate to prevent access to the illegally cut trail may help decrease unlawful use of the lake during this sensitive portion of the eagle nesting sequence.

The action alternatives also include funding and, in cooperation with Montana Fish, Wildlife, and Parks, building and placing an informative floating sign on Cyclone Lake near the loon brood-rearing area. Such a sign would ask for voluntary compliance from boaters, fishermen, etc., in keeping clear of sensitive areas for loons, particularly during the early spring period when they are most vulnerable to predation.

Alternatives B and C include timber harvesting (of differing amounts) on the west slope of Winona Ridge above the Cyclone Lake outlet (Unit 1 in both alternatives). In both cases, all transporting of logs would be via helicopter (no roads would be built). Helicopter flight paths are not yet known with precision; they would likely be more than 0.5 mile from areas of the lake frequented by loons. Little is known about the possible effects of helicopter traffic this distance from loon territories; it is possible that disturbance associated with either the cutting on Winona Ridge, helicopter transporting of logs across the outlet below Cyclone Lake, or both, could be detrimental to nesting loons. In recognition of this possibility, timing restrictions on helicopter flights over the Cyclone Lake outlet would not occur before August 1. This timing restriction is intended to avoid disturbing nesting eagles during the early portion of their nesting sequence when eagles are generally considered most sensitive to disturbance (MBEMP 1994:22); it would incidentally minimize disturbance to nesting loons. The timing restriction would reduce considerably, but not entirely, the risk that nesting loons would be adversely affected by this mechanized activity. Thus, Alternatives B and C include a small, albeit unquantifiable, risk of additional disturbance to the nesting loons during the latter portion of their nesting sequence. If the additional road-closure actions (described above) and/or erection of the floating sign were effective in reducing human use during early spring, they would benefit loons by reducing disturbance during the early portion of their nesting sequence. Without knowing a) the ultimate effectiveness of the road closures, b) the level of disturbance created by the helicopter flights, and c) specific reactions these particular loons may have to either, it is difficult to assess the net effect of the 2 offsetting actions.

Action Alternatives D and E do not include harvesting on the west slope of Winona Ridge (Unit 1 in Alternatives B and C), and thus do not pose any risk of additional disturbance to nesting loons. If the additional road-closure actions (described above) were effective in reducing human use during early spring, we would expect Alternatives D and E to produce a net benefit to nesting common loons.

Harlequin Duck (*Histrionicus histrionicus*)

Detrimental effects to harlequin ducks occur through habitat modification only when activity occurs close to streamside habitat. None of the action alternatives includes mechanized activity within designated SMZs; in most cases, buffers between stream edges and harvest units are greater than the minimum required widths. Thus, although we are unsure about the presence of harlequin ducks within Coal Creek State Forest, we are confident that any harlequins that do nest within Coal Creek State Forest would be unaffected by any alternative.

Boreal Owl (*Aeglius funereus*)

Alternatives A and F would cause little change in habitat characteristics for boreal owls.

Alternatives B and D would remove currently existing old stands that include some useable boreal owl habitat, mostly south of Coal Creek (Unit 5). Following harvesting, boreal owls might be able to use small remnant stands in this area because they do not require large, contiguous expanses of their preferred habitat (being, instead, adapted to flying among relatively small patches). In general, however, removing currently existing old forests with high components of Englemann spruce, subalpine fir, and western larch would be detrimental to boreal owls because it would reduce the acreage of their preferred habitat.

It is unclear what effects timber harvesting, as envisioned under Alternatives C and E, would have in these same stands. It has been suggested that some kinds of thinning can be consistent with managing for boreal owls (Knight 1994), but whether this thinning would retain needed habitat elements is unclear.

It is unlikely that boreal owls use stands other than those in Unit 5, so there would not be additional impacts to this species regardless of which alternative is chosen.

Black-backed Woodpecker (*Picoides arcticus*)

There are currently no recent burns on Coal Creek State Forest that provide nesting habitat for the black-backed woodpecker. The most recent burns are well older than is utilized by this woodpecker's preferred bark-boring beetle prey. Black-backed woodpeckers may occur as temporary visitors on Coal Creek State Forest because of a recent flush of nesting habitat from the large burns north and east of Coal Creek State Forest (Red Bench and Howling Wolf fires).

Barring stand-replacement burns, Alternatives A and F would do nothing to either improve or degrade the currently marginal habitat for black-backed woodpeckers provided by Coal Creek State Forest. Generally, the same could be said of each of the action alternatives. However, to the degree that they act to reduce the risk of a stand-replacement fire, action alternatives indirectly reduce the potential for future nesting capability.

Pileated Woodpecker (*Dryocopus pileatus*)

In the short-term, Alternatives A and F would leave the current relatively high quality of pileated woodpecker habitat intact within Coal Creek State Forest. Older trees and snags would remain in place for the next few decades. In the longer term, the abundance of large, old western larch would decrease because the species does not regenerate in the absence of fire and/or intensive timber harvesting. Western larch is the preferred nesting species for pileated woodpecker (particularly where ponderosa pine is virtually absent and cottonwood is rare, as in Coal Creek State Forest), so the continued absence of disturbance would, in time, decrease the quantity and quality of pileated woodpecker habitat.

Conversely, Alternatives B and D would reduce the quantity of acceptable pileated woodpecker habitat in Units 2 and 5, where the current old forest would be replaced by young stands. These stands would eventually lose these qualities in any case, because existing western larch would not be replaced without disturbance, but the timber harvesting would hasten this loss. Over the longer term, conversion of these stands to larch domination, should they grow old enough to produce large live trees, provides the potential for an abundance of pileated woodpecker habitat. Snag retention and recruitment efforts should ensure that "legacies" from the current stands continue to exist in the next one, which should be beneficial for pileated woodpeckers.

It is less clear what effects Alternatives C and E would have in these same stands. Overstory trees, most useful to pileated woodpeckers, would remain in place under these harvests. However, thinning the mid and lower stories sufficiently to allow growth of new larch trees may reduce habitat suitability for pileated woodpeckers, either because nesting would be deterred by the relatively open structure or nesting success would fail, due to easier access for potential predators on fledglings.

Northern Bob Lemming (*Synaptomys borealis*)

We currently know of no bog lemming habitat within Coal Creek State Forest. Although no thorough surveys of the entire Coal Creek State Forest have been conducted, areas of proposed timber harvesting have recently been surveyed thoroughly, and no sphagnum bogs are known in or near harvest units. Thus, we expect no effects on any bog lemmings that may reside in Coal Creek State Forest, regardless of which alternative is chosen.

Fisher (*Martes pennanti*)

For each Alternative, we evaluate effects on fisher by assessing the general abundance of mature forests and the existence of structure in and near riparian zones.

Under Alternatives A and F, old forests would continue to age and produce complex structure near the ground level (barring an uncontrolled fire). Habitat for fisher would probably improve incrementally. Analyses of forest vegetation and old-growth-associated attributes (see Indicators of Old-Growth Attributes) indicate that old forests would be reduced under any of the action alternatives. Alternatives B and D would reduce old growth by some 460 acres, whereas Alternatives C and E would reduce old growth by 42 acres. These figures probably overstate differences for the fisher however; thinning of shade-tolerant species, as proposed in Alternatives C and E, would likely remove a substantial portion of near-ground structure that fishers prefer (even though they would not move the stands from the "old" category). Similarly, differences between Alternatives B/D and C/E are probably unimportant for fisher; the dry, Douglas-fir dominated, southwestern slopes of Winona Ridge are not likely to be important for fisher, and removing some of the overstory Douglas-fir would not be likely to affect the species. Thus, we would expect some reduction in the overall quality of habitat for fisher within Coal Creek State Forest from any of the action alternatives.

As described in Chapter III, some 68% of low-elevation riparian zones that potentially provide optimum fisher habitat are of acceptable stocking density. Under Alternatives A and F, this condition would likely remain unchanged for the foreseeable future. Possible biases in this figure was discussed in Chapter III.

All harvest units in Alternatives B, C, D, and E are designed to allow buffers of no less than 50 meters (approximately 165 feet) on either side of streams within habitats likely to provide foraging and resting habitat for fishers. This should allow fishers to forage and travel through these areas at any time during the year. Thus, we do not anticipate substantial effects on fishers under any alternative.

Lynx (*Lynx canadensis*)

For each alternative, we evaluated effects on lynx by considering the 3 broad habitat components generally considered important for lynx in the Rocky Mountains:

- patches of older forests (for denning sites), with decadence and large, down stems, preferably in proximity to…

- patches of early to early/mid successional forests with high density of stems and/or herbaceous cover (for foraging), and

- patches of cover to allow travel between the first 2 (i.e., connectivity).

Assessment of the all 3 components was, essentially, qualitative in nature. To assess whether denning sites would be provided, we considered the availability of postalternative old stands with high levels of coarse, down woody debris. Additionally, we considered the retention of small patches containing dense forest cover with coarse, down woody debris within harvest units. To assess foraging sites, we considered the abundance of regenerating stands that, in the absence of thinning, often provide optimal habitat for the lynx' primary prey, snowshoe hares (*Lepus americanus*).

To assess connectivity, we produced a map showing all patches in which forest stocking was poor or lacking entirely. These patches were then buffered by 50 meters on each boundary; any mapped patch therefore represented a relatively open area of at least a 100-meter width at its narrowest point. These patches modeled movement barriers to lynx. We then assessed the spatial location of these movement barriers with respect to third-order drainages, as well as stands than contain potential foraging and denning habitat.

Lynx are also susceptible to trapping pressure, which in turn, is facilitated by road access. Issues of road access are considered thoroughly in the assessment of effects on grizzly bears (see Grizzly Bears, above).

Under Alternatives A and F, we expect little immediate change in the capability of Coal Creek State Forest to support lynx. Stands that contain structures appropriate for lynx denning would remain essentially unchanged; as they age, structure on the ground would gradually increase. Over the long term, denning habitat for lynx would probably increase slowly in both quantity and quality. Assuming continued fire suppression, stands that contain early to early/mid-successional structures would gradually decline in abundance. Connectivity between the two elements currently appears sufficient to allow for the free movement of lynx between them (Figure IV-16); this would not change appreciably in either the short or long term. Were fire suppression to continue long term and no additional timber harvests or prescribed burns to occur, the long-term trend would be a reduction in the heterogeneity of forest structures within Coal Creek State Forest and a gradual reduction in lynx habitat quality.

Harvest prescriptions in Alternative B include a relatively high proportion of stand-replacement-type harvests. In the short term, these harvested areas would be unusable by lynx, as they would lack sufficient forage for snowshoe hares and sufficient cover for travel or denning. Such disturbances are necessary over the longer term, however, to create early to early/midsuccessional stands in the future. Stands in both Units 2 (Section 14) and 5 (south of Coal Creek) contain structures that could potentially be used for denning; these structures would be reduced long-term by these harvests. In both Units, however, "reserves" would be left in small areas that, because of site-specific characteristics, would typically have escaped a stand-replacement burn. These retention areas may provide limited potential for future denning by lynx, even within these cutting units. Both Units 2 and 5 have boundaries that exclude riparian areas with high levels of both deciduous and coniferous cover that would likely provide both denning and travel habitat for lynx.

Foraging habitat may exist currently in Unit 6, and it would likely be reduced in quality by the proposed harvest, which would favor a more open, larch-dominated stand. Unit 7, dominated by lodgepole pine, may have provided conditions for a high-density snowshoe hare population in recent decades, but probably no longer serves that function. Timber harvesting, such as proposed under Alternative B, will reduce foraging quality further in the short term, but will likely reproduce a high quality foraging environment for snowshoe hares within a few decades.

Units 1, 3, and 4 are warmer, drier stands that likely never provided high-quality habitat for hares or lynx and will not do so following harvesting.

The juxtaposition of harvest units on the landscape (each of which would probably preclude lynx movement during 1 to 2 decades) would not produce large or insurmountable barriers to lynx movement across the landscape. Figure III-12, Lynx/Fisher Connectivity Map for Coal Creek State Forest, shows patches that are assumed to contain insufficient cover to allow lynx movement, as well as 50-meter buffers on all edges (i.e., boundaries of actual patches are 50 meters within mapped boundaries). These are modeled as forest stands on which stocking is either poor or lacking entirely. The resulting "unmapped" lands are, therefore, forest patches with stocking categorized as moderate or better, and no less than 100 meters wide in their narrowest direction. South of Coal Creek (in and near Unit 5), although relatively large patches of young forest would be produced, travel habitat would be retained within the riparian areas associated with all north-flowing creeks, as well as south of the harvest units (higher up on the ridge). Cover that could provide travel habitat would continue to be available on Coal Ridge, separating Coal and Cyclone Creeks. Connectivity between Cyclone Basin and the North Fork of the Flathead would be reduced (because of the harvesting in Unit 2), but the critical patch immediately northeast of Cyclone Lake would remain undisturbed. It is likely that cover in this "saddle" is already an important wildlife travel route, and the security provided by dense cover here would increase in importance following proposed harvests in Section 14 (Unit 2).

In summary, Alternative B would generally provide for a continuation of the shifting, heterogeneous mosaic of habitats that appears to support lynx in this area. Denning habitat would be reduced in extent, but most areas with the highest potential for denning would remain intact. Foraging habitat would remain unchanged or br reduced slightly in the short term, but increase in the longer term. Forest cover that provides connectivity between foraging and denning elements would be reduced from current conditions, but patches that are likely to be used currently would remain intact, and no large barriers to movement would be created.

Effects on lynx produced by Alternative C would be essentially identical to those of Alternative B because Unit 1 (which would be deleted under Alternative C) likely does not form an important habitat component for lynx.

Alternatives D and E include less removal of shade-intolerant canopy trees in Units 2 and 5 than do Alternatives B and C, but a similarly intensive removal of subcanopy shade-tolerant trees. Disturbance to herbaceous vegetation would probably be similar among treatments. In Unit 5, Alternatives D and E call for more extensive (albeit less intensive, see above) treatment than do Alternatives B and C, although the most mesic areas would still be retained. It is likely, however, that the lesser intensity harvests planned under Alternatives D and E would still remove sufficient densities of cover so that removal of potential denning habitat, as projected under Alternatives B and C, would also occur here. As well, forage habitat would probably not be created in the short term, but would be created within a few decades. In short, although the harvest prescriptions in Alternatives D/E differ from Alternatives B/C with respect to the types of fires they emulate and the time-to-return of various old-growth attributes, they probably do not differ appreciably with regard to their effects on lynx denning or forage habitat. Thus, effects on lynx would likely be similar to those described under Alternative B.

BIG GAME SPECIES

Elk

Elk may be affected by timber harvesting and associated activities by altering forage dynamics, by reducing the snow-intercept capability of the canopy, or by direct human disturbance.

Under Alternatives A and F, we would expect little short-term change in the abundance or availability of forage, snow interception, or direct human disturbance. Were a fire to occur, it would generally increase forage abundance at the expense of snow-intercept capability (however, it would remain general DNRC policy to suppress fires).

The conversion of older-aged, mixed-conifer stands to younger larch/Douglas-fir stands that figure prominently in Alternative B and D would generally increase summer forage abundance for elk. Following harvesting, jackpot burning would reinvigorate forage plants in patchy areas. Such harvesting would also reduce snow intercept, potentially making these forage plants unavailable during periods of snow cover. However, it appears that elk have not historically wintered in any of the stands for which this treatment is planned (Figure III-13). Thus, release of forage would generally be positive for elk in these stands.

Reduction of lodgepole cover in Unit 7 would also reduce snow intercept in this area, which might be important to elk wintering there (Figure III-13). This may reduce the value of this stand as a wintering area for elk.

Alternative D would have similar effects on elk, as well as a potential lessening of winter snow intercept in Unit 1 (Winona Ridge), which is also used by elk during winter. Winona Ridge already has patchy open areas, but these would increase under the proposed harvest. The degree to which additional openings would limit forage availability will vary depending on the severity of the winter and patterns of snowmelt.

Alternative C would have similar effects on elk to those of Alternative B. However, because all stand-conversion treatments target primarily the mid-canopy, both forage release and reduction of snow intercept would be less pronounced than under Alternative B.

Effects of Alternative E on elk would be generally similar to those of Alternative C, with the additional removal of snow-intercept capability from Unit 1 (Winona Ridge). The slightly smaller patch openings envisioned under Alternative E's treatments on Winona Ridge would reduce the magnitude of this removal.

Under no alternative do we anticipate detrimental effects on elk due to direct human disturbance. Elk are most sensitive to disturbance during winter when no mechanized activity would occur.

Mule Deer

Likely effects on mule deer largely parallel those for elk. Mule deer in western Montana are slightly more closely associated with closed canopy forest than are elk, so removal of overstory canopy would generally be slightly more detrimental.

Under Alternatives A and F, we would expect little short-term change in the abundance or availability of forage, snow interception, or direct human disturbance. Were a fire to occur, it would generally increase forage abundance at the expense of snow intercept capability (however, it would remain DNRC policy to suppress all ignitions).

The conversion of older-aged, mixed-conifer stands to younger larch/Douglas-fir stands that figure prominently in Alternative B would generally increase summer forage abundance for mule deer. Following harvesting, jackpot burning would reinvigorate forage plants in patchy areas. Such harvesting would also reduce snow intercept, potentially making these forage plants unavailable during periods of snow cover. However, it appears (Figure III-14) that mule deer have not historically wintered in any of the stands for which this treatment is planned. Thus, release of forage would generally be positive for mule deer in these stands.

Alternative D would have similar effects on mule deer, as well as a potential lessening of winter snow intercept in Unit 1 (Winona Ridge), which is also used by mule deer during winter. Winona Ridge already has patchy open areas, but these would increase under the proposed harvesting. The degree to which additional openings would limit forage availability will vary depending on the severity of the winter and patterns of snowmelt.

Alternative C would have similar effects on elk to those of Alternative B. However, because all stand-conversion treatments target primarily the mid-canopy, both forage release and reduction of snow intercept would be less pronounced than under Alternative B.

Effects of Alternative E on mule deer would be generally similar to those of Alternative C, with the additional removal of snow-intercept capability from Unit 1 (Winona Ridge). The slightly smaller patch openings envisioned under Alternative E's treatments on Winona Ridge would reduce the magnitude of this removal.

Under no alternative do we anticipate detrimental effects on mule deer due to direct human disturbance. Mule deer are most sensitive to disturbance during winter when no mechanized activity would occur.

White-tailed Deer

White-tailed deer are flexible in their summer habitat requirements, but are vulnerable to winter mortality from high snow depths. Therefore, winter ranges in western Montana are generally those with naturally low snow depths and/or a forest canopy that acts to intercept snow, thus reducing its depth on the ground.

Under Alternatives A and F, snow intercept would gradually increase as stocking density gradually increases. Were a stand-replacing fire to occur, burned areas would likely lose any value they had for wintering white-tailed deer, but become valuable for summer forage. In general, habitat capability for white-tailed deer under either alternative would remain similar to the current condition.

Under all action alternatives, timber harvesting, especially those that would be followed by jackpot burning, would likely increase summer forage quantity and quality. These increases in forage would be unavailable to whitetails during all but the mildest of winters. However, white-tailed deer in Coal Creek State Forest area evidently restrict their winter movements to the main North Fork of the Flathead River valley bottoms (Figure III-15), primarily east of Coal Creek State Forest. In those areas of Coal Creek State Forest that overlap this winter range, no harvests are planned. Thus, we expect the effects of any action alternatives on white-tailed deer to be neutral or, possibly, slightly positive.

Moose

Under Alternatives A and F, moose habitat would remain largely unaffected. Understory forage would probably diminish in quantity and quality, but very slowly as fire increasingly becomes a thing of the past. However, increased stem density would continue to provide some summer forage opportunities, as well as good winter habitat.

Under all action alternatives, timber harvesting, especially when followed by jackpot burning, would likely increase summer forage quantity and quality. Areas harvested by techniques that emulate stand-replacing fires (as in Units 2 and 5 in Alternatives B and D) would likely become unusable by moose during winter because of excessive snow depth and lack of conifers protruding above the snow line. It is unclear what effect the thinning harvests envisioned in Alternatives C and E would have on wintering moose; affected stands may also decline in winter-habitat quality. Other harvest units are unlikely to have substantial effects on moose. In general, we expect a slight increase in summer-forage quantity and quality from timber harvesting (and subsequent burning), and a slight decline in winter-habitat quality for all action alternatives.

WATERSHED

WATER QUALITY

The primary effect of forest management practices on water quality is sediment delivery to streams. Sediment is generated by road construction and use, especially from roads constructed along or across streams. Timber harvesting in or near riparian areas can also reduce the filtering capacity normally provided by vegetation in these areas. None of the proposed action alternatives would harvest timber in riparian areas. The harvesting activities proposed in all timber-harvesting alternatives would fully comply with current BMP standards and the SMZ law to minimize the risk of increased sedimentation from harvest units. DNRC has agreed to implement the Immediate Actions for Bull Trout Restoration recommended by the Governor's Bull Trout Restoration Team (Memo dated 12/5/94, Pat Flowers), so no harvesting would occur in an SMZ under any alternative. In addition, the requirements of the SMZ law would be surpassed by implementing the SFLMP guidance regarding martin/fisher buffers.

EFFECTS OF ALTERNATIVE A (NO-ACTION ALTERNATIVE)

Under the No-Action Alternative, no new roads would be constructed and no timber would be harvested. No new water-quality impacts would be generated in the watersheds considered in the proposal beyond those already occurring due to natural processes or past management. None of the proposed stream-crossing replacements, except for Dead Horse bridge over Coal Creek, would be done under this alternative; neither would roads be improved nor existing sediment sources repaired. These problems would continue to recover or degrade as dictated by natural and preexisting conditions until funding sources become available to repair them.

EFFECTS COMMON TO ALTERNATIVES B, C, D, AND E

East Face Winona Ridge

The primary impact to water quality from these alternatives would be the repair of the existing road system. Proposed repair activities:

installation of adequate surface drainage and ditch-relief structures over, approximately, 13 miles of existing road located on USFS and DNRC ownerships;
stabilization of several areas where cutslopes are unstable and slump frequently;
rerouting and dispersing surface and ditch runoff where they are routed directly to streams and draws; and
rehabilitating approximately 1 mile of existing low-standard road, installing surface-drainage features, removing all draw-crossing structures, reshaping draw bottoms, and seeding and permanently closing the road surface.

In addition, approximately .25 mile of new road would be constructed on private ownership on the east face of Winona Ridge. Along with this new construction, approximately 2 miles of existing low-standard road would be reconstructed and brought up to current BMP standards.

Cyclone Creek

The primary impact to water quality with these alternatives would be the improvement of the access road to Cyclone Lake. The road does not currently meet BMP standards and has unrestricted use. Under this alternative, this road would be brought up to current BMP standards. All other open roads in the Cyclone Creek watershed on DNRC ownership would also be brought up to current BMP standards with these action alternatives. In addition, after the road to Cyclone Lake is repaired, it will be closed seasonally from November 15 through July 1, which would further improve the water quality over the current condition. There may also be temporary road closures in the Cyclone Creek watershed during the period of harvesting operations. This closure would also be an additional benefit to water quality.

These closures, along with the proposed surface-drainage and ditch-relief improvements to the existing road system, may create short-term increases in sedimentation until the bare soil has a chance to revegetate, but would lead to a long-term net benefit to water quality by eliminating several existing sources of sediment.

Lower Coal Creek

The primary impact to water quality with these alternatives would be the improvement of the access roads on the south side of Coal Creek. This road system does not currently meet BMP standards and is not maintained behind the existing gate closure. Under this alternative, this road system would be brought up to current BMP standards with the installation of additional surface-drainage and erosion-control features. All other open roads in the Lower Coal Creek watershed on DNRC ownership and reaches on FNF land where the roads would be used for these alternatives would also be brought up to current BMP standards with these action alternatives. In addition, the failing bridge in Section 28 would be replaced with a properly designed steel bridge, and all road approaches and installation work would meet current BMP standards. A portion of the road into Cyclone Basin may be temporarily closed during the period of harvesting operations. These projects, along with the proposed surface-drainage and ditch-relief improvements to the existing road system, may create short-term increases in sedimentation until bare soil has a chance to revegetate, but would lead to a long-term net benefit to water quality by eliminating several existing sources of sediment.

South Fork of Coal Creek

The primary impact to water quality in the South Fork of Coal Creek with these timber-harvesting alternatives would be the improvement of the access roads in Section 30. This road system does not currently meet BMP standards and receives occasional maintenance behind the existing gate closure. Under these alternatives, this road system would be brought up to current BMP standards with the installation of additional surface-drainage and erosion-control features. Improvement of these features would prevent surface runoff from being concentrated above an existing slope failure located in Section 30. Stabilization of this slope failure would reduce the risk of sediment transfer to Coal Creek. In addition, a portion of existing open road located on both DNRC and FNF land in Sections 24 and 25, T34N, R22W, would be brought up to current BMP standards and closed with these action alternatives. These projects, along with the proposed surface-drainage and ditch-relief improvements to the existing road system, may create short-term increases in sedimentation until bare soil has a chance to revegetate, but would lead to a long-term net benefit to water quality by eliminating several existing sources of sediment.

EFFECTS OF ALTERNATIVE B

East Face of Winona Ridge

The 200 acres of timber harvesting proposed in this area would be removed using a low-pressure, soft-track skidder. This piece of equipment generates roughly 25% of the ground disturbance of a conventional tractor or rubber-tired skidder. The proposed unit is located well away from any draw or creek. These proposed activities, including the proposed road improvements, would lead to a net benefit to water quality through the elimination of several existing sediment sources.

Cyclone Creek

Of the 126 acres to be harvested in this watershed (Unit 1, Winona Ridge), 81 would be completed with a helicopter. The remaining acres would be skidded using conventional ground-based equipment. None of the stands proposed for harvesting in the Cyclone Creek watershed are near a creek or SMZ. Modeled sediment yields for this alternative indicate that the proposed activities, including harvesting and road improvements, would create a net benefit to water quality.

Lower Coal Creek

Of the 372 acres to be harvested in this watershed, 199 would be skidded using conventional ground-based machinery, and a low-pressure, soft-tracked machine would be used on 24 acres. The remaining 149 acres would be yarded using a combination of winching to existing roads, cable-yarding systems, and a helicopter. None of the stands proposed for harvesting in the Lower Coal Creek watershed are near a creek or SMZ. Modeled sediment yields for this alternative indicate that the proposed activities, including harvesting and road improvements, would create a net benefit to water quality.

South Fork of Coal Creek

Of the 77 acres proposed for harvesting with Alternative B, 39 would be yarded with a cable system. On the remaining acres, a low-pressure, soft-track skidder would be used to yard logs. The soft-track skidder creates approximately 25% of the bare soil in skid trails of a conventional ground-based machinery. Modeled sediment yields for this alternative indicate that the proposed activities, including harvesting and road improvements, would create a net benefit to water quality.

EFFECTS OF ALTERNATIVE C

East Face of Winona Ridge

Under Alternative C, the same acres would be harvested from the east face of Winona Ridge as those described under Alternative B. The prescription would leave more trees per acre, but would employ the same yarding equipment as that described under Alternative B, above. Water-quality impacts resulting from Alternative C would be the same as those described under Effects of Alternative B.

Cyclone Creek

Under Alternative C, the same stands would be harvested from the Cyclone Creek watershed as those described under Alternative B. The large stand on the west face of Winona Ridge would be harvested less intensively than in Alternative B; smaller patches of diseased timber would be harvested in Alternative C. A helicopter would be used to yard the logs in this stand with Alternative C. Water-quality impacts resulting from Alternative C would be the same as those described under Effects of Alternative B.

Lower Coal Creek

Of the 577 acres proposed for harvesting in the Lower Coal Creek watershed, 186 acres would be yarded with conventional ground-based machinery, and 242 acres would be skidded using a low-pressure, soft-track skidder. The soft-track skidder creates approximately 25% of the bare soil that conventional tractors or rubber-tired skidders generate. The remaining 149 acres would be yarded by either winching logs to an existing road, cable yarding, or flying logs to the landing with a helicopter. None of the stands proposed for harvesting in the Lower Coal Creek watershed are near a creek or SMZ. Modeled sediment yields for this alternative indicate that sediment yields to Coal Creek may be increased due to the ground disturbance generated by tractor and soft-track skidding. The WATSED model does not, however, take into account that there would be a minimum of 50 meters of vegetative buffer to filter sediment, and, in most cases, harvest units are at least 200 feet from a live stream. In most cases, a road, which also acts as an interceptor of water and sediment, lies between a proposed harvest unit and a live creek. With all of the proposed improvements to the surface drainage and ditch relief on the existing road system, any sediment that may be generated and carried out of a proposed harvest unit would be dispersed in a vegetative filter and never reach a live stream.

South Fork of Coal Creek

Of the 144 acres proposed for harvesting with Alternative C, 39 would be yarded with a cable system. A low-pressure, soft-track skidder would be used to yard logs on the remaining acres. The soft-track skidder creates approximately 25% of the bare soil in skid trails of conventional ground-based machinery. Modeled sediment yields for this alternative indicate that sediment yields to Coal Creek may be increased due to the ground disturbance generated by soft-track skidding. The WATSED model does not, however, take into account that there would be a minimum of 50 meters of vegetative buffer to filter sediment, and, in most cases, the harvest units are at least 200 feet from a live stream. In the South Fork of Coal Creek watershed, a road, which also acts as an interceptor of water and sediment, lies between the proposed harvest units and the creek. With all of the proposed improvements to the surface drainage and ditch relief on the existing road system, any sediment that may be generated and carried out of a proposed harvest unit would be dispersed in a vegetative filter and never reach a live stream.

EFFECTS OF ALTERNATIVE D

East Face of Winona Ridge

The water-quality effects to the east face of Winona Ridge from Alternative D would be identical to those described under the effects of Alternative B. All proposed harvest acres, silvicultural treatments, logging systems, and road improvements would be the same in Alternative D as those discussed for Alternative B.

Cyclone Creek

The water-quality effects to the Cyclone Creek watershed from Alternative D would be identical to those described under the effects of Alternative B, with one exception. Under Alternative D, the stand on the west face of Winona Ridge would not be harvested. All other aspects of Alternative D are identical to those discussed under Alternative B, including road repairs, potential road closures, and other proposed harvest units. Alternative D would have a net benefit to water quality due to the proposed road improvements and a lower risk of water-quality impacts than Alternative B since the stand on the west face of Winona Ridge would not be treated.

Lower Coal Creek

The water-quality effects to the Lower Coal Creek watershed from Alternative D would be identical to those described under the effects of Alternative B. All proposed harvest acres, silvicultural treatments, logging systems, road improvements, and the bridge replacement would be the same in Alternative D as those discussed for Alternative B.

South Fork of Coal Creek

The water-quality effects to the South Fork of Coal Creek watershed from Alternative D would be identical to those described under the effects of Alternative B. All proposed harvest acres, silvicultural treatments, logging systems, and road improvements would be the same in Alternative D as those discussed for Alternative B.

EFFECTS OF ALTERNATIVE E

East Face of Winona Ridge

The water-quality effects to the east face of Winona Ridge from Alternative E would be identical to those described under the effects of Alternative C. All proposed harvest acres, silvicultural treatments, logging systems, and road improvements would be the same in Alternative E as those discussed for Alternative C.

Cyclone Creek

The water-quality effects to the Cyclone Creek watershed from Alternative E would be identical to those described under the effects of Alternative C, with one exception. Under Alternative E, the stand on the west face of Winona Ridge would not be harvested. All other aspects of Alternative E are identical to those discussed under Alternative C, including all road repairs, potential road closures, and other proposed harvest units. Alternative E would have a net benefit to water quality due to the proposed road improvements, and a lower risk of water-quality impacts than Alternative C since the stand on the west face of Winona Ridge would not be treated.

Lower Coal Creek

The water-quality effects to the Lower Coal Creek watershed from Alternative E would be identical to those described under the effects of Alternative C. All proposed harvest acres, silvicultural treatments, logging systems, road improvements, and the bridge replacement would be the same in Alternative E as those discussed for Alternative C.

South Fork of Coal Creek

The water-quality effects to the South Fork Coal Creek watershed from Alternative E would be identical to those described under the effects of Alternative C. All proposed harvest acres, silvicultural treatments, logging systems, and road improvements would be the same in Alternative E as those discussed for Alternative C.

EFFECTS OF ALTERNATIVE F

The water-quality effects to each of the watersheds in the proposed project area from Alternative F would be similar to those described under the effects of Alternative A. This alternative would not involve timber harvesting. Alternative F would propose a deferral of planned timber harvesting to allow a larger analysis area (North Fork) to be examined. The purpose of this analysis would be to determine how the resource values in Coal Creek State Forest relate to those found in the North Fork of the Flathead River basin. Alternative F would, however, complete all road improvements, the bridge replacement, potential road closures, and slope stabilization described for the other action alternatives. Implementation of Alternative F would create a net benefit to water quality in each drainage found in the proposed project area through the repair of existing long-term sources of sediment.

CUMULATIVE WATERSHED EFFECTS

The potential watershed cumulative effects of the alternatives were determined using the PC version of the R1WATSED model developed by Region 1 of the USDA Forest Service. WATSED estimates the increase in water yield caused by removal of live trees using the Equivalent Clearcut Area (ECA) method. This model also estimates sediment production and delivery resulting from road construction and timber harvesting. WATSED is limited in its estimates of sediment routing because it does not attempt to account for sediment generated from the bed and banks of a stream adjusting to increases in water yields. All modeling results are estimates based on empirical formulas and should be used for comparison of alternatives rather than as actual values.

EFFECTS COMMON TO ALL ALTERNATIVES

FNF is proposing the Deadhorse Resource Management Project to be completed during the summer of 1999. This project involves a controlled burn of high-elevation alpine timber to promote the regeneration of whitebark pine. The burn is located in the Dead Horse Creek tributary to Coal Creek near the ridge dividing the Dead Horse and Lower Coal creek watersheds. This burn would not affect the water quality in the Lower Coal watershed unless the fire goes out of control and crosses the ridge to the north. Any fire that may burn into the Lower Coal watershed would generate ECA in the Lower Coal watershed and may lead to increased sedimentation through the removal of forest cover and ground vegetation.

EFFECTS OF ALTERNATIVE A

The No-Action Alternative would generate no cumulative watershed impacts beyond those under current management. Current water yield increases (WYI) and ECA levels for each watershed in the project area are listed in the attached table under the No-Action heading. Under this alternative, these values would remain at or near present levels and would continue to decline as past harvest units continue to regenerate and move closer to predisturbance levels of water use and snowpack distribution.

EFFECTS COMMON TO ALTERNATIVES B, C, D, AND E

EFFECTS OF ALTERNATIVE B

This alternative proposes to harvest timber from approximately 931 acres in the proposed project area. No new roads would be constructed to access any of the proposed stands. Approximately 218 acres of the proposed harvest are located on the east face of Winona Ridge. The prescription is a combination of clearcut with reserve trees over most of the area, with clumps of trees at shelterwood spacing. The approximate crown removal in this unit would be 89%. Due to the lack of continuous flow in the watersheds on this side of

Winona Ridge, the moderate extent of past timber-harvesting activity, and the advanced vegetative recovery in the existing units, the proposed harvesting would not generate adverse cumulative impacts to any of the intermittent draws on the east face of Winona Ridge. The remaining 713 acres of proposed harvesting would take place in the Cyclone Creek, Lower Coal Creek, and South Fork of Coal Creek watersheds. In the Cyclone Creek watershed, Unit 1, having an estimated 232 acres, would harvest 81 acres from the west face of Winona Ridge using a helicopter for yarding. The prescription would consist of a seedtree harvest with islands of trees at a shelterwood spacing. The prescription would remove pockets of root-rot-infected trees that have either died or are badly diseased with an approximate crown removal of 85%. Most of the remaining proposed harvest units would be located on the slope south of Coal Creek. These units would have the same prescriptions as described above, with the exception of a clearcut with reserves treatment in a 162-acre stand of lodgepole pine. See Tables IV-16 and IV-17 for a comparison of the action alternatives for each watershed in the proposed project area. As shown, none of the watersheds would be moved toward the conservative 10% water yield increase threshold.

EFFECTS OF ALTERNATIVE C

Alternative C would harvest timber from approximately 1,226 acres in the proposed project area. No new roads would be constructed to access any of the proposed stands. Of the 1,226 acres, 218 acres would be harvested from the east side of Winona Ridge. The harvest prescription would be a combination thinning of understory trees with patches of seedtree treatments. The remaining 1,008 acres would be harvested from the Cyclone Creek, Lower Coal Creek, and South Fork of Coal Creek watersheds. Alternative C would treat the same stand on the west side of Winona Ridge with the same prescription as Alternative B, but would treat smaller patches. Most of the remaining 824 acres proposed for harvesting in Alternative C would be located on the ridge south of Coal Creek. This alternative would treat approximately 495 acres using a combination of thinning understory trees mixed with patches of seedtree treatments, removing approximately 33% of the canopy. Tables IV-15, IV-16, and IV-17 display the approximate acres proposed for harvesting in each of the watersheds and the ECA and water-yield increases expected from this alternative. None of the watersheds would near its threshold of concern for ECA or water-yield increases with Alternative C.

EFFECTS OF ALTERNATIVE D

Alternative D would harvest approximately 699 acres in the proposed project area. No new roads would be constructed to access any of the proposed stands. This alternative would harvest the same acres as Alternative B, using the same harvest prescriptions, with the exception of Unit 1 on the west face of Winona Ridge. In Alternative D, this unit would not be harvested, leaving root rot pockets untreated and allowing for the natural mortality of affected trees. Tables IV-15, IV-16, and IV-17 display the impacts of Alternative D on each of the affected watersheds. The watershed cumulative effects of this alternative on the east face of Winona Ridge would be the same as those listed in the effects of Alternative B. This alternative would not bring any of the watersheds in the proposed project area near the recommended thresholds of concern.

EFFECTS OF ALTERNATIVE E

Alternative E would harvest approximately 994 acres in the proposed project area. No new road would be constructed to access any of the proposed stands. This alternative would harvest the same acres as Alternative C, using the same harvest prescriptions, with the exception of Unit 1 on the west face of Winona Ridge. In Alternative E, this unit would not be harvested, leaving root rot pockets untreated and allowing for natural mortality of affected trees. Tables IV-15, IV-16, and IV-17 display the impacts of Alternative E on each of the affected watersheds. The watershed cumulative effects of this alternative on the east face of Winona Ridge would be the same as those listed in the effects of Alternative C. This alternative would not bring any of the watersheds in the proposed project area near the recommended thresholds of concern.

EFFECTS OF ALTERNATIVE F

Alternative F would have similar watershed cumulative effects to those of Alternative A, a no-action alternative. Timber harvesting would be deferred under this alternative until a larger analysis area (North Fork) could be analyzed to assess values located in Coal Creek State Forest. Water yield and ECA levels would remain at or near current levels and would continue to recover as past harvest units continue to revegetate. Upon completion of a landscape analysis, a new action alternative may be implemented.

TABLE IV-15 - COMPARISON OF WATSED-PREDICTED WATERSHED EFFECTS BY ALTERNATIVE FOR CYCLONE CREEK

Alternative	**Acres Harvested**	**Miles of Road Construction**	**ECA Generated**	**Total ECA[1]**	**% Water Yield Increase[2]**
A (No Action)	0	0	0	491	3%
B	126	0	116	607	4%
C	103	0	95	586	4%
D	45	0	44	535	3%
E	45	0	44	535	3%
F	0	0	0	491	3%

[1] The values shown here reflect the total ECA generated from both road construction and harvesting.

[2] Allowable water-yield increase was set at 10% in compliance with the SFLMP Record of Decision. The allowable ECA values listed in Chapter III are based on this level of water-yield increase.

TABLE IV-16 - COMPARISON OF WATSED-PREDICTED WATERSHED EFFECTS BY ALTERNATIVE FOR LOWER COAL CREEK

Alternative	Acres Harvested	Miles of Road Construction	ECA Generated	Total ECA[1]	% Water Yield Increase[2]
A (No Action)	0	0	0	384	1%
B	372	0	357	741	2%
C	577	0	257	641	2%
D	372	0	357	741	2%
E	577	0	257	641	2%
F	0	0	0	384	1%

[1] The values shown here reflect the total ECA generated from both road construction and harvesting.

[2] Allowable water-yield increase was set at 10% in compliance with the SFLMP Record of Decision. The allowable ECA values listed in Chapter III are based on this level of water-yield increase.

TABLE IV-17 - COMPARISON OF WATSED-PREDICTED WATERSHED EFFECTS BY ALTERNATIVE FOR THE SOUTH FORK OF COAL CREEK

Alternative	Acres Harvested	Miles of Road Construction	ECA Generated	Total ECA[1]	% Water Yield Increase[2]
A (No Action)	0	0	0	615	3%
B	77	0	71	686	3%
C	144	0	12	627	3%
D	77	0	71	686	3%
E	144	0	12	627	3%
F	0	0	0	615	3%

[1] The values shown here reflect the total ECA generated from both road construction and harvesting.

[2] Allowable water-yield increase was set at 10% in compliance with the SFLMP Record of Decision. The allowable ECA values listed in Chapter III are based on this level of water-yield increase.

VISUAL CHARACTERISTICS

EFFECTS OF ALTERNATIVE A

Alternative A would not affect the visual characteristics of the project area. However, the visual character of the project area would gradually be altered by natural processes and natural disturbances over time.

EFFECTS OF ALTERNATIVES B AND D

Alternatives B and D would emulate a high-intensity fire by making clearcuts with approximately 6 to 8 reserve trees per acre. Reserve trees would include an average of 2 sound western larch or Douglas-fir trees at least 21 inches DBH for future snag recruitment, other live trees that are at least 66% cull (unmerchantable due to defect, size, or because a portion of the tree is missing), and healthy western white pine. The effects of these alternatives would be visible from the North Fork and Glacier Route 7 roads and would change the visual characteristics of the area.

Within the perimeters of the clearcuts, wetter sites up to 2 acres in size would be lightly harvested to more closely emulate a moderate-severity fire. Within these sites, individual trees, such as subalpine fir, spruce, and lodgepole pine, that would likely be killed by a moderate-severity fire, would be harvested. These sites would represent an estimated 15% of the perimeter of the clearcut with reserves.

As the edge of the adjacent mature forest is approached, a feathering effect would be created by retaining an increasing number of western larch, Douglas-fir, and western white pine. This feathering effect would lessen the visual impacts of the harvest by softening edges and more aptly mimicking natural disturbances. Approximately 225 western larch and western white pine seedlings would be planted per acre to supplement natural regeneration. Figure IV-17 shows the location of the harvest prescription on the landscape at the location where this analysis was done.

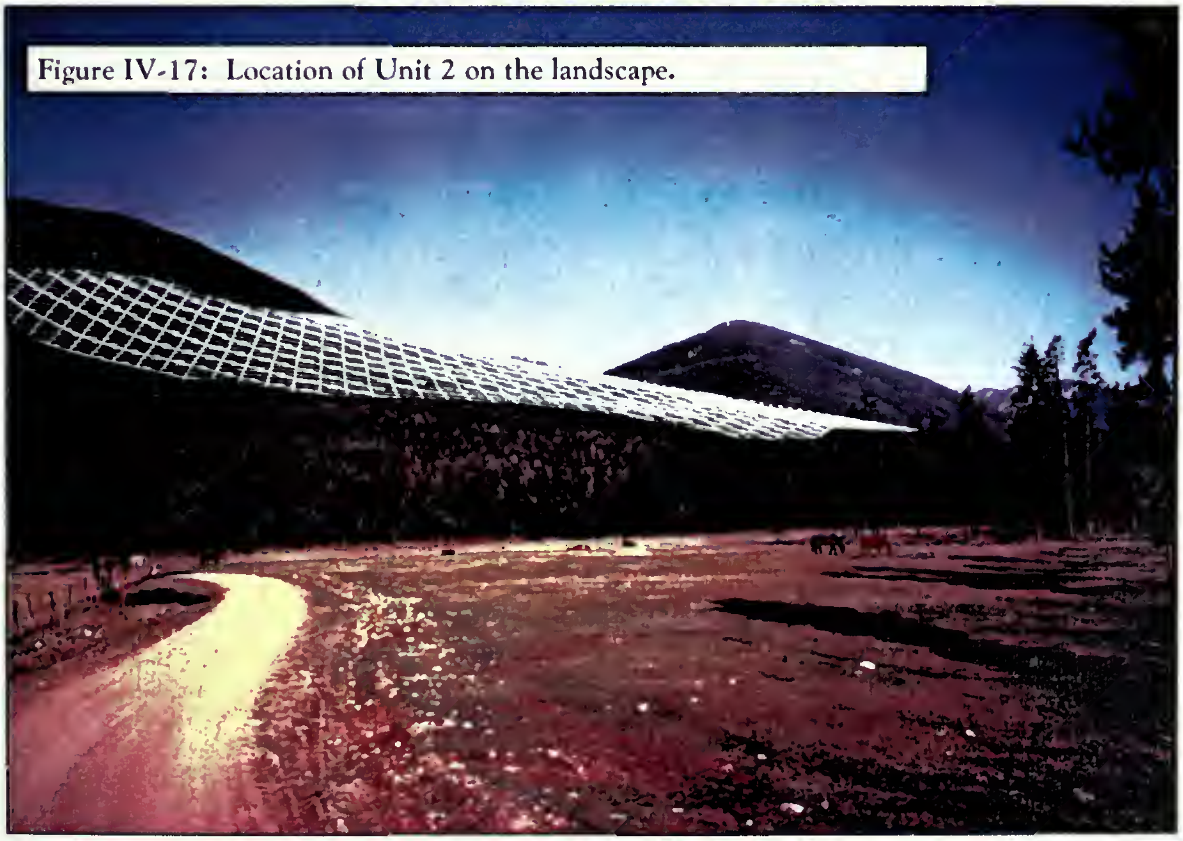


Figure IV-17: Location of Unit 2 on the landscape.

EFFECTS OF ALTERNATIVES C AND E

Alternatives C and E would emulate the low- and moderate-intensity fires that burn during intervals between the less-frequent, high-intensity fires. The intensity of these types of fires results in the mortality of thin-barked trees, such as spruce, subalpine fir, and lodgepole pine, with a higher survival rate of the more fire-resistant trees, such as western larch and old Douglas-fir.

These alternatives, which employ thinning-from-below silvicultural treatments, would retain most of the large, fire-resistant trees within treated stands, enabling these stands to recover old-growth qualities in a shorter period of time after harvesting. Approximately 90% of the subalpine fir and spruce would be harvested, and about 80% of the western larch and Douglas-fir, which dominate the forest, would be retained. Openings where all trees would be harvested, up to 5 acres in size, would be scattered over about 15% of the area.

The effects of these alternatives would be visible from the North Fork and Glacier Route 7 roads, but would mimic the natural thinning that has occurred in several stands on the east face of Winona Ridge. These treatments would change the visual characteristics of the area to a lesser degree than Alternatives B and D. Approximately 225 western larch and western white pine seedlings would be planted per acre in openings to supplement natural regeneration.

EFFECTS OF ALTERNATIVE F

Alternative F would not affect the visual characteristics of the project area. However, the visual character of the project area would gradually be altered by natural processes and natural disturbances over time.

ECONOMICS

METHODS

The basic method for the economic analysis is nondiscounted cash flow. The cash flow analysis tries to estimate the flow of revenues and costs from the different treatments that are only related to this project. No future activities are included due to the fact that projecting treatments into the future is uncertain due to changes in policy, markets, personnel, and random natural events. The analysis estimates the cash flow from timber harvesting or deferring the project for 2 years, and nonadministrative costs for the alternatives considered. DNRC does not have a formal accounting system to track costs for individual projects from start to finish. An annual cash-flow analysis is conducted of DNRC's forest product sales program. The revenue-to-cost ratios is a measure of the economical efficiency of the program. For the last two years, for every 1.0 dollar DNRC spent on costs, $1.51 in revenue has been generated by NWLO.

The results of this analysis appears in Table IV-18 through Table IV-22.

ASSUMPTIONS

The following assumptions were used to estimate the revenue and nonadministrative costs for each alternative:

- The estimated harvest volumes for the treatments and alternatives are based on estimates made by Stillwater Unit personnel based on data in the stand-level inventory and field reconnaissances.

- The estimated stumpage price (the winning bid for a timber sale), was estimated using the last year Transaction Evidence equation as if the entire alternative was sold as one sale. The original estimates for stumpage price made late in 1997 had higher estimates for development costs, but due to the current market (5/98), they were not adjusted higher to reflect the current lower-estimated development costs. The current stumpage market (8/98) is soft, the estimated stumpage prices could be 10% to

25% too high. During the implementation phase of this project, 2 different sales were created; the estimated total revenue could be different, but the relative total revenue difference between the alternatives should be the same.

- Development costs were estimated by the Stillwater Unit and NWLO personnel. Development costs for Alternatives B, C, D, and E are estimated to be $350,000. Development costs for Alternatives A and F are estimate to be in the range of $200,000 to $350,000. Development costs on this proposal are the estimated costs to bring roads up to BMPs, replacement of the Dead Horse bridge, additional seasonal gates, and treating noxious weeds that would be paid for by the purchaser for Alternatives B, C, D, and E. Alternatives A and F will be funded from the forest improvement (FI) account. Funding these project out of the FI account could, potentially, reduce the revenue to the trust and, potentially, increase the FI fee in the future (assuming we receive further authorization to spend the additional funding or delay the lower-priority projects).

- The FI cost is based on the cost to maintain the ongoing staffing, stand and road maintenance treatment needs for the current year, right-of-way acquisition, and programwide costs. Funds collected under FI from a purchaser provide the State funding to accomplish projects, such as tree planting, site preparation, slash treatment, thinning, road maintenance, right-of-way acquisition, and some timber-sale-related activities. Thus, the State is able to improve the long-term productivity of timber stands on State land and maintain or acquire access for future revenue-producing projects.

- Sale-specific FI costs are the current cost estimates for the amount and types of treatments, such as site preparation, hazard reduction, and planting, that are planned related to each of the alternatives being considered. Funding to complete these projects will be collected from current or future timber sales, depending on the timing of the treatments.

- The estimated total timber dollar return to the trust is the estimated stumpage price (winning bid price per MBF) times the estimated harvest volume.

- The estimated total timber dollar amount collected by the State (total revenue) is FI costs plus the estimated stumpage price times the estimated harvest volume.

- Sale-specific FI costs were estimated based on the following cost estimates:

  - Machine pile and burn - $135.75/acre
  - Broadcast/jackpot burn - $135/acre
  - Planting - $106.25/acre (seedling and planting cost of $.45/tree x 220 trees/acre + $7.25/acre administration cost)

These costs were estimated based on a discussion with Rick Komenda, Management Forester at Stillwater Unit. It was assumed for the economic analysis that we will plant at a density of 220 trees per acre, but for implementation, we will wait a couple of years and evaluate the current stocking and species mix before determining what stocking level and species to plant. Some jackpot burning will be done along with the broadcast burning. The cost for jackpot burning is substantially less than broadcast burning, but due to the uncertainty with the costs for leave-tree protection and the estimated cost of broadcast burning, the total cost per acre is assumed to be the same. Some of the leave trees will be killed by the burning activity. The treatment acres and costs by alternative are as follows:

TABLE IV-18 - SALE-SPECIFIC FOREST-IMPROVEMENT ACRES TREATED BY METHOD AND ALTERNATIVE

ALTERNATIVE	TREATMENT METHOD		
	Broadcast/Jackpot Burn	**Machine Pile and Burn**	**Planting**
A	0	0	0
B	633.8	159.2	631
C	779.6	262.4	292.5
D	552.8	159.2	550
E	721.6	262.4	292.5
F	0	0	0

TABLE IV-19 - SALE-SPECIFIC FOREST-IMPROVEMENT COST BY ALTERNATIVE, METHOD, AND TOTAL

ALTERNATIVE	TREATMENT METHOD			
	Broadcast/ Jackpot Burn	**Machine Pile and Burn**	**Planting**	**Alternative Total**
A	0	0	0	0
B	$86,038	$21,611	$67,044	$174,693
C	$105,831	$35,621	$31,078	$172,530
D	$75,043	$21,611	$58,438	$155,092
E	$97,957	$35,621	$31,078	$164,656
F	0	0	0	0

- The costs related to the administration of the timber sale program is only tracked at the land office and Statewide level. There is no formal accounting system at the unit level to track costs for individual timber sales.

- Limitations of the economic analysis:
  - only known costs and benefits that are related to timber-harvesting activities are considered;
  - none of the potential benefits associated with leaving trees (snag recruitment, structural diversity, aesthetics, wildlife habitat, nutrient cycling, etc.) are considered.

- Alternative A (No Action) - There are no money-making activities that are solely dependent on this project area.

- There is potential for cabinsites or a resort along the North Fork Road on trust land. The opportunity for cabinsites or a resort in the interior of Coal Creek State Forest is very limited to none due to the presence of grizzly bears.

- The estimation value for Alternative F was based on a discounted cash-flow analysis for delaying the scheduled payment from the Coal Creek proposal for 2 years and reducing the annual sold target for the NWLO (memos in Coal Creek project file).

- DNRC has a sustained-yield, even-flow volume level of 42.164 MMBF per year Statewide. If timber is not sold and harvested relating to the highest volume alternative in this project, timber will be sold and harvested somewhere else.

- The following is an estimation of the future road-maintenance costs associated with this project area (details on cost assumptions are in the project file):
    - Open-road maintenance costs - yearly blading, brushing once every 3 to 5 years, and spraying once every 3 to 5 years.
    - Gated-road maintenance costs - blading once or twice every 10 years, brushing once every 10 years, and spraying once every 10 years.

The average annual nondiscounted cost estimate for open roads equals $340/mile; for gated roads, $85/mile. The discounted value (at 4%) for open roads is $271/mile and for graded roads, $68.4/mile. Additional costs related for dealing with slumps, rock armor, culverts, etc., that occur every year for the entire Stillwater Unit are in the $4,000 to $5,000 range.

TABLE IV-20 - 10 YEARS OF COSTS IN THE COAL CREEK PROJECT AREA (NOT INCLUDING ADDITIONAL STILLWATER-WIDE COSTS)

	Miles	**10 Years of Nondiscounted Costs**		**10 Years of Discounted (@4%) Costs**	
		Per Mile	**Total**	**Per Mile**	**Total**
Open roads	17	$3,400	$57,800	$2,711	$46,087
Gated roads	19	$850	$16,150	$684	$12,996
Totals	36		$73,950		$59,083
Annual costs			$7,395		$5,908
Annual cost per acre[1]			$0.5		$0.4

[1] Annual road maintenance cost per acre = Annual cost/Coal Creek project acres

In addition to the average road maintenance cost per mile, there are other road maintenance costs of $4,000 to $5,000 per year on Stillwater Unit. These estimated costs are for dealing with slumps, rock armor, culverts, etc., that occur every year, but not in a predictable location. These costs are prorated to the Coal Creek project area based on acres. The acre numbers used for this are: Coal Creek project area equals an approximate 15,060 acres and the forested area on the Stillwater Unit equals 93,000 acres.

Coal Creek project area share: ADDITIONAL costs per year ranges between $647.74 (4,000*(15,060;/93,000)) to $809.68 ($5,000*(15,060/93,000)).

Average additional cost per acre: $0.04 (647.74/15060) to $0.05 (809.68/15,060).

Total estimated road maintenance cost per acre per year (per mile + additional Stillwater Unit-wide cost) are: nondiscounted costs range + $0.53 to $0.54 per acre per year and discounted costs range = $0.43 to $0.44 per acre per year.

ESTIMATED NONDISCOUNTED CASH FLOW

EFFECTS OF ALTERNATIVES A, B, C, D, E, AND F

TABLE IV-21 - COSTS AND BENEFITS ASSOCIATED WITH THE COAL CREEK PROJECT BY ALTERNATIVE (NONDISCOUNTED)

	ALTERNATIVES					
	A	B	C	D	E	F
1. Estimated total harvest volume (MBF) (Assumption 1)	0	10,865	9,383	10,005	8,803	0
2. Development Cost ($/MBF) (Assumption 3)	Total Cost ($200,00 to $350,000[1])	$32.21	$37.30	$34.98	$39.76	Total Cost ($200,00 to $350,000[1])
3. Estimated stumpage value ($/MBF) (Assumption 2)	$0	$284.92	$214.02	$287.59	$220.87	0
4. FI ($/MBF) (Assumption 4)	$0	$46.41	$46.41	$46.41	$46.41	0
5. Estimated Stumpage Value, FI, and Development Cost ($/MBF) (Line 2 + line 3 + line 4)	$0	$363.54	$297.73	$368.98	$307.04	0
6. Total timber $ value based on estimated stumpage value, FI cost and development cost times estimated harvest volume (line 5 * line 1)	($200,00 to $350,000)	$3,949,900	$2,793,615	$3,691,670	$2,702,866	($200,00 to $350,000[1])
7. Estimated stumpage value and FI ($/MBF) (line 3 + line 4)	$0	$331.33	$260.43	$334.00	$267.28	0
8. Total timber $ revenue to the State (estimated stumpage value + FI cost times estimated harvest volume) (line 7 * line 1)	$0	$3,599,900	$2,443,615	$3,341,607	$2,352,866	0
9. Total timber $ returned to the trust (line 1 * line 3)(No administration costs included)	$0	$3,095,656	$2,008,150	$2,877,338	$1,944,319	0
10. Estimated deferral income	$0	$0	$0	$0	$0	$139,667
11. Sale-specific FI costs ($/MBF) (line 12/line 1)	$0	$16.08	$18.39	$15.50	$18.70	$0
12. Total $ sale-specific FI costs (Table IV-5 alternative total cost column	$0	$174,693	$172,530	$155,092	$164,656	$0

[1]Funded from FI account.

Table IV-22 - YARDING METHOD PERCENTAGES BY UNIT

Yarding Method	Units							
	1	2	3	4	5 Alternatives B and D	5 Alternatives C and E	6	7
Helicopter	100%	0	0	0	20%	50%	0	0
FMC	0	30%	0	0	60%	30%	0	0
Line Machine	0	0	0	0	20%	20%	0	0
Tractor	0	70%	100%	100%	0	0	100%	100%

Table IV-23 - HARVEST VOLUME (MBF) BY LOGGING COST YARDING METHOD AND ALTERNATIVE

Yarding Method	Alternatives					
	A	B	C	D	E	F
Helicopter	0	1,458	2,776	648	2,196	0
FMC	0	3,515	2,167	3,515	2,167	0
Line Machine	0	648	878	648	878	0
Tractor	0	5,243	3,562	5,243	3,562	0
Totals	0	10,865	9,383	10,055	8,803	0

Table IV-24 - AVERAGE VOLUME WEIGHTED LOGGING COST[1] PER MBF BY ALTERNATIVE

	Alternatives					
	A	B	C	D	E	F
Average Logging Cost $ per MBF	0	$105	$156	$92	$147	0

[1] The average logging costs per MBF used for Alternatives B and D were: helicopter - $270; FMC - $92; line machine - $115; tractor - $67.40. The average logging costs per MBF used for Alternatives C and E were: helicopter - $300; FMC - $106; line machine - $106; tractor - $78.20. The higher costs for alternatives C and D are due to the lower harvesting per acre and the lower average DBH of the harvested trees.

ESTIMATED LOGGING AND YARDING METHOD VOLUMES AND COSTS

The next 3 tables estimate the percentage of yarding method by unit, total volume by yarding method and alternative, and the average logging cost by alternative.

TIMBER-RELATED JOBS AND INCOME

EFFECTS OF ALTERNATIVES B, C, D, AND E

The impacts on local communities are estimated by quantifying jobs and income associated with harvesting and processing the timber into final products. Regional response coefficients estimated for northwestern Montana indicate that timber harvesting provides 10.58 direct jobs per million board feet, and a total direct income of $337,146 (Keegan *et al.*) for an average annual income of $31,866.35 per job.

It is important to note that the response coefficients are an accounting of what has happened historically. These response coefficients are average values and are not marginal values. To say the consequence of not selling this sale would result in the loss of XX amount of jobs and YYY amount of income may not be correct. A marginal analysis would have to be done in order to be more certain that there would be a reduction in income and employment. Lack of a marginal analysis and the use of average numbers commonly results in overestimation of the total economic effects (Godfrey and Beutler 1993).

EFFECTS OF ALTERNATIVES A AND F

For alternative A, the no-action alternative, there will be no jobs generated that relate to harvesting timber from this project. But there may be related timber jobs due to harvesting because of the natural events (fire, blow down, etc.) that could occur after the no-action alternative is selected. For Alternative F, the short-term effects (2 years) will be no jobs that related to harvesting timber from this project. But after the deferral time there is potentially more or less jobs related to this project based on the current and, potentially, new alternative(s) developed.

HARVEST-VOLUME AND SUSTAINED-YIELD ESTIMATES

Table IV-25 estimates the time before DNRC would enter this project area again based on the Statewide sustained-yield study for the alternatives considered. The time interval is estimated by dividing the estimated harvest volume for each alternative by 806 MBF. The 806 MBF is one estimate of the average annual contribution that the Coal Creek Project Area makes to the total Statewide annual sustained yield of 42,164 MBF. It is calculated in Chapter III and is based on the average NWLO harvest volume per year per acre times the manageable acres from the sustained-yield study. The value estimated for Alternative F is derived by only looking at the short term (2 years). Values for Alternatives B, C, D, E and F range between 10.9 to 13.5 years. One method to increase the profitability of the DNRC timber program is to increase this interval.

TABLE IV-25 - THE ESTIMATED NUMBER OF YEARS BEFORE THE NEXT SALE BASED ON THE SUSTAINED-YIELD STUDY GIVEN THE ALTERNATIVE HARVEST VOLUME

	Alternatives					
	A	B	C	D	E	F
1. Estimated volume harvested (MBF)	0	10,865	9,383	10,005	8803	0
2. Estimated annual sustained-yield harvest volume (MBF) from Coal Creek Project Area	806	806	806	806	806	806
3. Estimated number of years before next sale (row 1/row 2)	0	13.5	11.6	12.4	10.9	0

IRRETRIEVABLE AND IRREVERSIBLE COMMITMENTS OF NATURAL RESOURCES

IRRETRIEVABLE

According to Shipley (1995), irretrievable commitments of resources are lost for a period of time. Many stands in the project area are mature with many individual trees more than 200 years old. Any of the timber-harvesting alternatives would cause some of these large, old, live trees to be irretrievably lost; they would no longer contribute to future snag recruitment, stand structural and compositional diversity, aesthetics, wildlife habitat, nutrient recycling processes, or any other important ecosystem functions.

IRREVERSIBLE

According to Shipley (1995), irreversible commitments of resources are commitments that cannot be reversed or replaced. The initial loss of trees due to timber harvesting would not be irreversible. Natural regeneration combined with site preparation and artificial regeneration would promote the establishment of new trees. If management decisions allow for the continued growth of established trees, they would ultimately become equivalent in size and age to the irretrievably harvested trees.

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GLOSSARY

Acre-foot
A measure of water or sediment volume, equal to an amount of material that would cover one acre to a depth of one foot.

Aesthetic
(a) Generally the study, science, or philosophy dealing with beauty and with judgements concerning beauty. (b) Giving visual pleasure. © The theory of perception or of susceptibility.

Airshed
An area defined by a certain set of air conditions; typically a mountain valley in which air movement is constrained by natural conditions such as topography.

Appropriate Conditions
Describes the set of forest conditions determined by the DNRC to best meet SFLMP objectives. The four main components useful for describing an appropriate mix of conditions are cover type proportions, age class distributions, stand structural characteristics and the spatial relationships of stands (size, shape, location, etc.) all assessed across the landscape.

Basal Area
A measure of the number of square feet of space occupied by the stem of a tree.

Best Management Practices (BMP)
Guidelines that should be used to direct forest activities and protect water quality.

Bioaccumulate
The process of a plant or animal selectively taking in or storing a persistent substance. Over time, a higher concentration of the substance is found in the organism then in the organism's environment.

Biocontrol Agents
Noxious weed control without the use of chemicals, machines, fire or hand tools. Parasites, grazing, predators, diseases, etc. are used to control.

Biodiversity
The variety of life, and its processes. It includes the variety of living organisms, the genetic differences among them, and the communities and ecosystems in which they occur.

Board Foot
144 cubic inches of wood, equivalent to piece of lumber 1-inch thick by 1-foot wide by 1-foot long.

Boreal Forest
The type of forest found in the Northern Temperate Zones and Arctic region.

Canopy
The upper level of a forest, consisting of branches and leaves of taller trees.

Cavity
A hollow excavated in trees by birds or other animals. Cavities are used for roosting and reproduction by many birds and mammals.

Clearcut
A type of regeneration or harvest cut which removes all trees from a stand. A new stand develops from stored seed, seed from adjacent stands, sprouts, or advance regeneration.

Compaction
Increase in soil density caused by force exerted at the soil surface, modifying aeration and nutrient availability.

Connectivity
The quality, extent, or state of being joined; unity; the opposite of fragmentation.

Contrast
A term used in visual assessments to indicated the degree to which objects are distinguishable from one another.

Core Area
See Security Habitat (grizzly bears)

Corridor

- *Mature forest corridor* - A contiguous area of mature forest at least 100 meters wide, having at least 40 percent canopy cover, and connecting two or more larger areas of mature forest.
- ***Movement corridor*** **- A narrow but continuous area of habitat connecting larger areas of habitat that animals use for travel. Often referred to as "dispersal " or "wildlife" corridor.**

Cover
See HIDING COVER and/or THERMAL COVER.

Co-dominant Tree
A tree which extends its crown into the canopy, receiving direct sunlight from above and limited sunlight on its sides. One or more sides are crowded by crowns of dominant trees.

Crown Cover or Crown closure
The percentage of a given area covered by the crowns of trees.

Cutting Units
Areas of timber proposed for harvest.

Cull
A tree of such poor quality that it has no merchantable value in terms of the product being cut.

Discounting
In economics, a method of accounting for the value of money over time, its ability to earn interest, so that costs and benefits occurring at different points in time are brought to a common date for comparison.

Ditch Relief
A method of draining water from roads using ditches and a corrugated metal pipe. The pipe is placed just under the road surface.

Down Woody Debris
Dead trees within a forest stand that have fallen and begun decomposing on the forest floor.

Dominant Tree
Those trees within a forest stand which extend their crowns above surrounding trees and capture sunlight from above and around the crown.

Drain Dip
A graded depression built into a road to divert water and prevent soil erosion.

Ecosystem
An interacting system of living organisms and the land and water that make up their environment; the home place of all living things, including humans.

Environmental Effects
The impacts or effects of a project on the natural and human environment.

Equivalent Clearcut Area (ECA)
The total area within a watershed where timber has been harvested, including clearcuts, partial cuts, roads, and burns.

- *Allowable* ECA - The estimated number of acres that can be clearcut before stream channel stability is affected.
- *Existing* ECA - The number of acres that have been previously harvested taking into account the degree of hydrologic recovery that has occurred due to revegetation.
- *Remaining* ECA -The calculated amount of harvest that may occur without substantially increasing the risk of causing detrimental effects to stream channel stability.

Excavator Piling
Piling of logging residue using an excavator.

Fire Regimes
Describes the frequency, type and severity of wildfires. Examples include: frequent, non-lethal underburns; mixed severity fires; and stand replacement or lethal burns.

Forage
All browse and non-woody plants available to wildlife for grazing.

Forest Improvement
The establishment and growing of trees after a site has been harvested. Associated activities include site preparation, planting, survival checks, regeneration surveys, and thinning of the stand.

Fragmentation (forest)
A reduction of connectivity and increase in sharp stand edges resulting when large contiguous areas of forest with similar age and structural character are interrupted through disturbance (e.g., stand replacement fire, timber harvesting).

Habitat
The place where a plant or animal naturally or normally lives and grows.

Habitat Effectiveness
The percentage of available habitat that is useable by ungulates during the nonhunting season (in comparison to potential ungulates use).

Habitat Type
The place or type of site where a plant or animal naturally or normally lives and grows.

Hazard Reduction
The abatement of a fire hazard by processing logging residue with methods such as separation, removal, scattering, lopping, crushing, piling and burning, broadcast burning, burying, and chipping.

Hectare (ha)
Ten thousand square meters or 2.47 acres.

Hiding Cover

- *Grizzly Bear* - A patch of vegetation having a minimum width of at least three sight distances (distance at which 90 percent of a bear is hidden from view) or 300 feet--whichever is greater.

Historical Forest Condition
The condition of the forest prior to settlement by Europeans.

Intermediate Trees
A characteristics of certain tree species which allows them to survive in relatively low light conditions, although they may not thrive.

Interdisciplinary Team
A team of resource specialists brought together to analyze the effects of a project on the environment.

Irretrievable Commitment of Resources
Resources that are lost for a period of time, such as harvested timber or other renewable natural resources. A stand of trees that is cut has been irretrievably lost (as opposed to irreversibly lost) because the stand can regenerate.

Irreversible Commitment of Resources
Loss of resources that cannot be reversed except perhaps in the extreme long term, such as minerals, historical or archaeological resources; or vegetation and habitat lost to permanent roads. Irreversible also refers to the loss of future options.

Landscape
A land area with interacting ecosystem.

Mitigation Measure
Measure designed to reduce or prevent detrimental effects.

Moving Window
A computer-based method which, in this EIS, is used to quantify the area influenced by roads in a study area. Starting with the pixel in the upper left corner of the computerized subunit map, the computer calculates how many miles of road exist within a 1 square mile "window" around that pixel. It moves to the next pixel and repeats the process until the road density is calculated in a 1 square mile area around every pixel in the study area. The number and percentage of pixels in the study area that fall into different road density classes are then calculated by the computer. Based on research studying the effects of roads on grizzly bears, the effects of open roads are measured by the percentage of the pixels in the study area which have at least 1.0 miles of open road in the surrounding 1 square mile window. The effects of total roads (open, gated, barricaded, bermed but not brushed, etc.) are measured by the percentage of pixels in the study area which have at least 2 miles of open or restricted roads in the surrounding 1 square mile window.

Multistory Stands
Timber stands with two or more distinct stories.

Nest Site Area (Bald Eagle)
The area in which human activity or development may stimulate abandonment of the breeding area, affect successful completion of the nesting cycle, or reduce productivity. It is either mapped for a specific nest, based on field data, or, if that is impossible, is defined as the area within a 1/4 mile radius of all nest sites in the breeding area that have been active within 5 years.

No-action Alternative
The option of maintaining the status quo and continuing present management activities and/or not implementing the proposed project.

NOEL
The no-observable-effect level. In a series of dose levels tested, it is the highest level at which no effect is observed in the species tested.

Non-forested Area
A naturally occurring area where trees do not establish over the long-term such as a bog or avalanche chute.

Old Growth

- The term old growth is sometimes used to describe the later, or older stages of natural development of forest stands. Characteristics associated with old-growth generally include relatively large old trees, containing wide variation in tree sizes, exhibiting some degree of multi storied structure, having signs of decadence such as rot and spike-topped structure, and containing standing large snags and large down logs.
- Subsequent to the adoption of the SFLMP, DNRC identified old growth in the SLI. Currently DNRC is identifying old stands and old stands with old growth characteristics in the SLI.

Old Stands
Stands with an average age of 150 years and older, except for lodgepole pine which needs to be over 140 years of age.

Over story
The level of the forest canopy including the crowns of dominant, codominant and intermediate trees.

Patch
A discrete area of forest connected to other discrete forest areas by relatively narrow corridors; an ecosystem element (such as vegetation) that is relatively homogeneous internally but differs from what surrounds it.

Patch Shape Index
A system for assessing patch shape, or a number indicating this shape. The system used in this EIS was developed by McGarigal and Marks (1994). Under this system, a perfectly square patch is represented by the number 1. Circular patches are indicated with numbers less than one. The higher the number, the more complex the shape.

Potential Nesting Habitat (Bald Eagle)
Sometimes referred to as Suitable Nesting Habitat, areas that have no history of occupancy by breeding bald eagles, but containing potential to do so.

Primary Use Area (Bald Eagle)
An area that includes the most frequently used perch and foraging sites. If unmapped, the area between a and mile radius of all nest sites in the breeding area that have been active within 5 years. In the case of the Cyclone lake bald eagle nest, it is on p. 22 of McFadzen (1992)

Project File
A public record of the analysis process, including all documents that form the basis for the project analysis. The project file for the Cyclone/Coal Timber Harvest Project EIS is located at the Stillwater State Forest office near Olney, Montana.

Redds
The spawning ground or nest of various fish.

Regeneration
The replacement of one forest stand by another as a result of natural seeding, sprouting, planting, or other methods.

Residual Stand
Trees remaining uncut following any cutting operation.

Road Improvements
Construction projects on an existing road to improve ease of travel, safety, drainage, and water quality.

Roads
The following kinds of roads were considered in road density estimates for grizzly bear habitat.

- *Administrative roads* - Administrative roads provide access to administrative structures or to non-corporate private property. Administrative roads are excluded from calculations of open road density and total road density.
- *Open roads* - Open roads pertaining to the grizzly bear analysis are roads without use restrictions. They are seasonally opened to the public during the non-denning period (3/16 - 11/15). They are administered by DNRC, Plum Creek, or the U.S. Forest Service (USFS).
- *Private roads* - Roads on nonindustrial private lands. Private roads are excluded from open and total road density estimates.
- *Reclaimed roads* - Reclaimed roads are generally impassable to motorized vehicles for most of their length. Drainage features on the road are not maintained because future use of the roads is not intended. Reclaimed roads are not included in linear mileage or road density calculations.
- *Restricted roads* - A road administered by DNRC, USFS, or Plum Creek on which motorized use is restricted during the entire non-denning period (3/16-11/15) by a physical obstruction. Restricted roads are included in calculations of total road density.

Saplings
Trees 1.0 inches to 4.0 inches in diameter at breast height.

Saw-timber Trees
Trees or logs cut from trees, with a minimum dbh of 9 inches.

Scarification
The mechanized gouging and ripping of surface vegetation and litter to expose mineral soil and enhance the establishment of natural regeneration.

Scoping
The process of determining the extent of the environmental assessment task. Scoping includes public involvement to learn which issues and concerns should be addressed, and the depth of assessment that will be required. It also includes a review of other factors such as laws, policies, actions by other landowners, and jurisdictions of other agencies that may affect the extent of assessment needed.

Security
For wild animals the freedom from the likelihood of displacement or mortality due to human disturbance or confrontation.

Security Habitat (grizzly bears)
An area of at least 2,500 acres that is at least 0.3 miles from trails or roads with motorized travel and high-intensity, non-motorized use during the non-denning period.

Seedlings
Live trees less than 1.0 inch dbh.

Sediment
In bodies of water, solid material, mineral or organic, that is suspended and transported or deposited.

Sediment Yield
The amount of sediment that is carried to streams.

Seral
Refers to a biotic community that is in a developmental, transitional stage in ecological succession.

Shade-intolerant
Describes tree species that generally can only reproduce and grow in the open or where the Over story is broken and allows sufficient sunlight to penetrate. Often these are seral species that get replaced by more shade-tolerant species during succession. In the Coal Creek State Forest, shade-intolerant species generally include ponderosa pine, western larch, Douglas-fir, white pine, and lodgepole pine.

Shade-tolerant
Describes tree species that can reproduce and grow under the canopy in poor sunlight conditions. These species replace less shade-tolerant species during succession. In the Coal Creek State Forest, shade-tolerant species generally include subalpine fir, grand fir, Douglas-fir, Engelmann spruce, and western red cedar.

Sight Distance
In the case of grizzly bears, refers to the distance at which 90 percent of a bear is hidden from view.

Silviculture
The art and science of controlling the establishment, composition, and growth of forests, to accomplish specific objectives.

Site Preparation
A hand or mechanized manipulation of a harvested site to enhance the success of regeneration. Treatments are intended to modify the soil, litter, and vegetation and to create microclimate conditions conducive to the establishment and growth of desired species.

Slash
Branches, tops, and cull trees left on the ground following a harvest.

Snag
A standing dead tree or the portion of a broken off tree. Snags may provide feeding and/or nesting sites for wildlife.

Snow Intercept
The action of trees and other plants in catching falling snow and preventing it from reaching the ground.

Spur Roads
Temporary roads, closed after harvest, constructed to meet minimum requirements for harvest-related traffic.

Stand
An aggregation of trees occupying a specific area and sufficiently uniform in composition, age arrangement, and condition as to be distinguishable from the adjoining forest.

Stand Density
Number of trees per acre.

Stocking
The degree of occupancy of land by trees as measured by basal area or number of trees and as compared to a stocking standard, which is an estimate of either the basal area or number of trees per acre required to fully use the growth potential of the land.

Stream Gradient
The slope of a stream along its course, usually expressed in percentage indicating the amount of drop per 100 feet.

Stumpage
The value of standing trees in the forest. Sometimes used to mean the commercial value of standing trees.

Substrate Scoring
Rating of a stream bed particle sizes.

Succession
The natural series of replacement of one plant (and animal) community by another over time in the absence of disturbance.

Suppressed
The condition of a tree characterized by low growth rate and low vigor due to competition with overtopping trees.

Texture
A term used in visual assessments indicating distinctive or identifying features of the landscape depending on distance.

Timber Harvesting Activities
In general, "timber harvesting activities" refers to all the activities conducted to facilitate timber removal before, during, and after the timber is removed. These activities may include any or all of the following:

- felling standing trees and bucking into logs
- skidding logs to a landing
- processing, sorting, and loading logs at the landing
- hauling logs to a mill
- road construction
- right-of-way clearing
- excavation of cut/fill material
- installation of road surface and ditch drainage features
- installation of culverts at stream crossings
- burning right-of-way slash
- hauling and installation of borrow material

- blading and shaping road surfaces
- slashing and sanitizing residual vegetation damaged during logging
- machine piling logging slash
- burning logging slash
- scarification
- planting trees

Total Road Density
See ROADS

Understory
The trees and other woody species growing under a more-or-less continuous cover of branches and foliage formed collectively by the overstory of adjacent trees and other woody growth.

Uneven aged stand
A group of trees of a variety of ages and sizes growing together on a uniform site.

Ungulates
Hoofed mammals such as mule deer, white tail deer, elk, moose, of which most are herbivorous and many are horned.

Vigor
The degree of health and growth of a tree or stand.

Vigor Class
The following vigor classes are based on the SRSF Stand Level Inventory.

- *full vigor* - The full vigor class is represented by open-grown trees. Crown closure has not occurred, and growth is optimal.
- *good-to-fair vigor* - Crowns are closed at least in clumps; crown lengths are greater than 50 percent in young stands and greater than 33 percent in older stands. Growth has not yet slowed greatly.
- *fair-to-poor vigor* - Crown ratios are poor. Growth and mortality are nearly balanced.
- *very poor vigor* - Stands having very poor vigor are generally in a decadent condition due to insects, disease, stagnation, suppression or old age. Mortality is likely to exceed growth.

WATSED
A computer model that uses existing condition data to predict increases in water yield over natural conditions and related increases in sediment entering streams.

Watershed
The region or area drained by a river or other body of water.

Water Yield
The average annual runoff for a particular watershed expressed in acre-feet.

Water Yield Increase
An increase in average annual runoff over natural conditions due to forest canopy removal.

Windthrow
A tree pushed over by wind. Windthrows (blowdowns) are common among shallow rooted species and in areas where cutting has reduced the density of a stand so that individual trees remain unprotected from the force of the wind.

APPENDIX A

STIPULATIONS AND SPECIFICATIONS FOR THE CYCLONE/COAL TIMBER SALE

Stipulations and specifications for the action alternatives were identified or designed to prevent or reduce potential effects to resources considered in this analysis. In part, stipulations and specifications are a direct result of issue identification and resource concerns. This section is organized by resource.

Stipulations and specifications that apply to operations required by and occurring during the contract period would be contained within the Timber Sale Contract. As such, they are binding and enforceable. Stipulations and specifications relating to activities, such as hazard reduction, site preparation and planting, that may occur during or after the contract period would be enforced by project administrators.

The following stipulations and specifications are incorporated to mitigate effects on resources involved with the action alternatives considered in this proposal.

WATERSHED AND FISHERIES

1. Planned erosion-control measures include: graveled portions of roads, slash-filter windrows, grass seeding, and road closures. Details for these control measures would be included in Appendix B of the Timber Sale Agreement.

2. Streamside Management Zones (SMZs) have been defined where they occur within or adjacent to harvest areas. This was done to protect areas adjacent to streams to maintain water quality.

3. Culvert sizing for all road projects will be as recommended by the DNRC hydrologist.

4. Stream crossings, where culvert installations are planned, will have the following requirements, as needed, to meet Best Management Practices (BMPs) and protect water quality:

   a. Slash-filter windrows will be constructed on the approach fills.
   b. Filter-fabric fences will be in place downstream prior to and during culvert installation.
   c. Erosion-control fences will be installed on fill slopes at crossing sites and remain in place until the slopes stabilize and revegetate.
   d. Diversion channels will be constructed and lined with plastic to divert stream flow prior to any in-channel operations.
   e. Except for the machine used to construct the crossing, stream crossing with any machine is prohibited. The machine used for the crossing construction will be limited to no more than 2 crossings.
   f. Water-quality monitoring will continue in the Coal Creek drainage and Cyclone drainages to assess and track water quality and resource values associated with water quality. In addition, the monitoring will provide data for water-quality studies being conducted in the Flathead basin.

5. Brush would be removed from existing road prisms to allow effective road maintenance. Improved road maintenance would reduce sediment delivery.

6. The contractor would be responsible for the immediate cleanup of any spills (fuel, oil, dirt, etc.) that would affect water quality.

7. Fuel-leaking equipment would not be permitted to operate in stream-crossing construction sites.

8. Included in the project proposal are the following pertinent recommendations of the Flathead Basin Forest Practices, Water Quality and Fisheries Cooperative Program Final Report.

The following numbers correspond to the numbering of recommendation items contained within the aforementioned document, included in pages 154 through 162 of the final report:

1) BMPs are incorporated into the project design and operations of the proposed project.

2) Riparian indicators were considered in the harvest unit layout.

3) Management standards of the Streamside Management Zone Law (75-5-301 MCA) are used in conjunction with the recommendations of the study.

4) The BMP audit process will continue. This sale will likely be reviewed in an internal audit and may be picked at random as a Statewide audit site.

7) SMZs will be evaluated as a part of the audit process.

11) Coal Creek monitoring is part of the Flathead Basin monitoring effort.

12) Watershed-level planning and analysis are complete. Logging plans of USFS, as reported to the Cumulative Watershed Effects Cooperative, are used.

14) DNRC is cooperating with the Department of Fish, Wildlife and Parks (DFWP) on a further study of the fish habitat and populations for Coal Creek and its tributaries.

15) DNRC will use the best methods available for logging and road building for this proposal.

16A)Existing roads are fully utilized for this proposal.

17) DNRC requested inventory information from DFWP. DNRC's mitigation plan for roads fits all recommendations for "impaired streams". Using "worst case scenario" criteria provides for conservative operations in this proposal.

18) Provisions in the Timber Sale Agreement address BMPs that are rigidly enforced.

20) Planning for long-term monitoring of Coal Creek is in place.

29-34) DNRC has cooperated with DFWP for continuing fisheries work. DNRC will continue to monitor fisheries in the future as funding allows.

HERBICIDES

To further limit the possible spread of weeds, the following integrated weed-management mitigation measures of prevention and control will be implemented:

1. Clean weed-plant parts and mud from road-construction and skidding equipment of prior to entering the site.
2. Revegetate disturbed roadsides and landings with site-adapted grasses. For grass seeding to be effective, to complete seeding concurrent with road construction is important.
3. The contractor is required to control weeds along access roads by herbicide methods as designated by the Forest Officer in charge.

Herbicide Application

To reduce risk to aquatic and terrestrial resources, the following will be required:

1. All herbicides will be applied by licensed applicators in accordance with laws, rules and regulation of the State of Montana and the Flathead County Weed District.
2. All applications would adhere to Montana BMPs and the herbicide's specific label guidelines.
3. Herbicide application would not be general, but site specific, to areas along roads where noxious weeds are occurring. All no-spray areas will be designated on the ground before application begins.
4. Picloram would not be applied within 50 feet of surface water. 2,4-D could be applied to within 25 feet of surface water. No herbicides would be applied within 25 feet of surface water.

5. Herbicides would not be applied to areas where relief may contribute runoff directly into surface water.

6. Application would be applied on calm, dry days to limit drift and possible surface movement off road prisms.

GRIZZLY BEARS

The following items are incorporated into this proposal:

1. Seeding plans to revegetate roads include a combination of seed mixtures that have different palatability in relation to grizzly bears. Less palatable species are planned for areas where bear use is to be discouraged to minimize potential for bear/human conflicts, while desirable species are used where forage is intended to be complimented.

2. No logging camps would be allowed in the sale area.

3. Garbage hauling would be required daily.

4. The Forest Officer would immediately suspend any or all activities directly related to the proposed action if necessary to prevent imminent confrontation or conflict between grizzly bears and humans or other threatened or endangered species and humans.

5. Vigorous patches of Vaccinium sp., will be avoided during scarification when possible.

6. Contractors will be prohibited, while working under contract, from carrying firearms onto closed roads.

7. The road leading to Cyclone Lake will be seasonably restricted by a gate during the spring.

WOLVES

A contract provision would be included to protect any wolf den site within the gross sale area that may be discovered during implementation of this proposal.

SNAG RETENTION

High-quality wildlife trees, such as large, broken-topped western larch, will be designated for retention and given special consideration during yarding operations to prevent loss.

ROADS

1. Road-construction activities and road use associated with road-construction activities will be relayed to the general public.

2. BMPs would be incorporated in all planned road construction.

VISUALS

1. Damaged residual vegetation would be slashed.

2. The location, size, and number of landings would be limited.

3. Disturbed sites along road right-of-ways would be grass seeded.

4. Pockets or strips of the residual stands along topographic breaks and roadsides would be retained to limit views into harvest units.

ARCHAEOLOGY

1. A contract clause provides for suspending operations if cultural resources are discovered; operations may only resume as directed by the Forest Officer.

2. A review of the project area was conducted by a DNRC archaeologist.

SOILS

COMPACTION

1. Logging equipment will not operate off forest roads unless soil moisture is less than 20%, frozen to a depth that will support machine operations, or snow covered to a depth that will prevent compaction, rutting, or displacement.

2. Existing skid trails and landings will be used where their design is consistent with prescribed treatments and meets current BMP guidelines.

3. Designated skid trails would be required where moist soils or short steep pitches (less than 300 feet) would not be accessed by other logging systems. This would reduce the number of skid trails and the potential for erosion.

4. Where designated skid trails are required, timber on the trails will be felled and skidded before the remaining timber in a harvest unit is felled. This would define felling patterns, facilitate skidding on designated trails, and reduce the harvest unit area impacted by skidding equipment. Skidding plans are required to be in place prior to the start of logging operations.

5. Skid trail density in a harvest area will not exceed 15% of the total area.

SOIL DISPLACEMENT

1. To prevent displacement and erosion of topsoil, hard-track, ground-based skidding equipment will not be operated on steep slopes (greater than 45%).

2. Brush piling with dozers requires use of an approved brush rake.

3. Designated skid trails would be required in all areas where tractor yarding is proposed. Existing skid trails will be used when possible.

4. Lopping and scattering will be used for hazard reduction to retain woody debris onsite for nutrient cycling.

EROSION

1. Ground-skidding machinery will be required to be equipped with a winchline to limit the equipment-operation area.

2. Roads used by the purchaser will be reshaped and the ditches redefined following use. This will reduce surface erosion.

3. Drain dips and gravel will be installed on roads, as needed, to improve road drainage and reduce maintenance needs and erosion.

4. Some road sections will be repaired to upgrade the roads to design standards that reduce erosion potential and maintenance needs.

5. Prompt and timely applications of certified weed-free grass seed and fertilizer would be applied to all newly constructed road surfaces and cut-and-fill slopes. Applications would also be applied to any existing disturbed cut-and-fill slopes and landings immediately adjacent to open roads. This would be done to stabilize soils and reduce or prevent noxious weed establishment, to include:

    a. Seeding all road cuts and fills concurrent with construction.
    b. Apply "quick cover" seed mix within one day of when work is completed at culvert installation sites.
    c. Seeding all road surfaces and reseeding culvert installation sites when the final blading is completed for each specified road segment.

6. Water bars, logging-slash barriers, and, in some cases, temporary culverts will be installed on skid trails where erosion is anticipated, based on ground and weather conditions, as directed by the forest officer. These erosion control features will be periodically inspected and maintained throughout the contract period or extensions thereof.

AIR QUALITY

Item 1 is designed to prevent individual or cumulative effects during burning operations. Items 2 and 3 are designed to reduce effects from burning operations.

1. Burning operation will be in compliance with the Montana Airshed Group reporting regulations and any burning restrictions imposed in Airshed 2. This would provide for burning during acceptable ventilation and dispersion conditions.

2. Cover dozer, landing, and road-work debris piles. This will allow ignition to occur during spring when ventilation is good and surrounding fuels are wet. Covered piles are drier, ignite easier, burn hotter, and extinguish sooner due to the higher relative humidity during spring. This will reduce dispersed (unentrained) smoke.

3. Maximize the amount of woody debris left on site. Fuels not burned do not produce smoke. If possible, larger fuels should be left and smaller fuels should be piled.

4. Consider other debris-disposal methods for road construction and road-improvement projects. This would include lopping and scattering, trampling, hand piling, chipping, etc. Road right-of-way piles tend to be shaded by surrounding timber stands and do not seem to dry as well as piles in harvest units.

5. Dust abatement would be applied on segments of Coal Creek Road, FS 317, that are being used for hauling and would benefit most from dust abatement.

6. An alternative disposal method for slash produced by road right-of-way work, other than piling and burning, would be encouraged.

NOXIOUS WEED MANAGEMENT

1. Surface blading may be required on roads affected by the proposal to remove weeds before the seed-set stage.

2. All tracked and wheeled equipment are required to be clean of noxious weeds prior to beginning project operations. The contract administrating officer will inspect equipment periodically during project implementation.

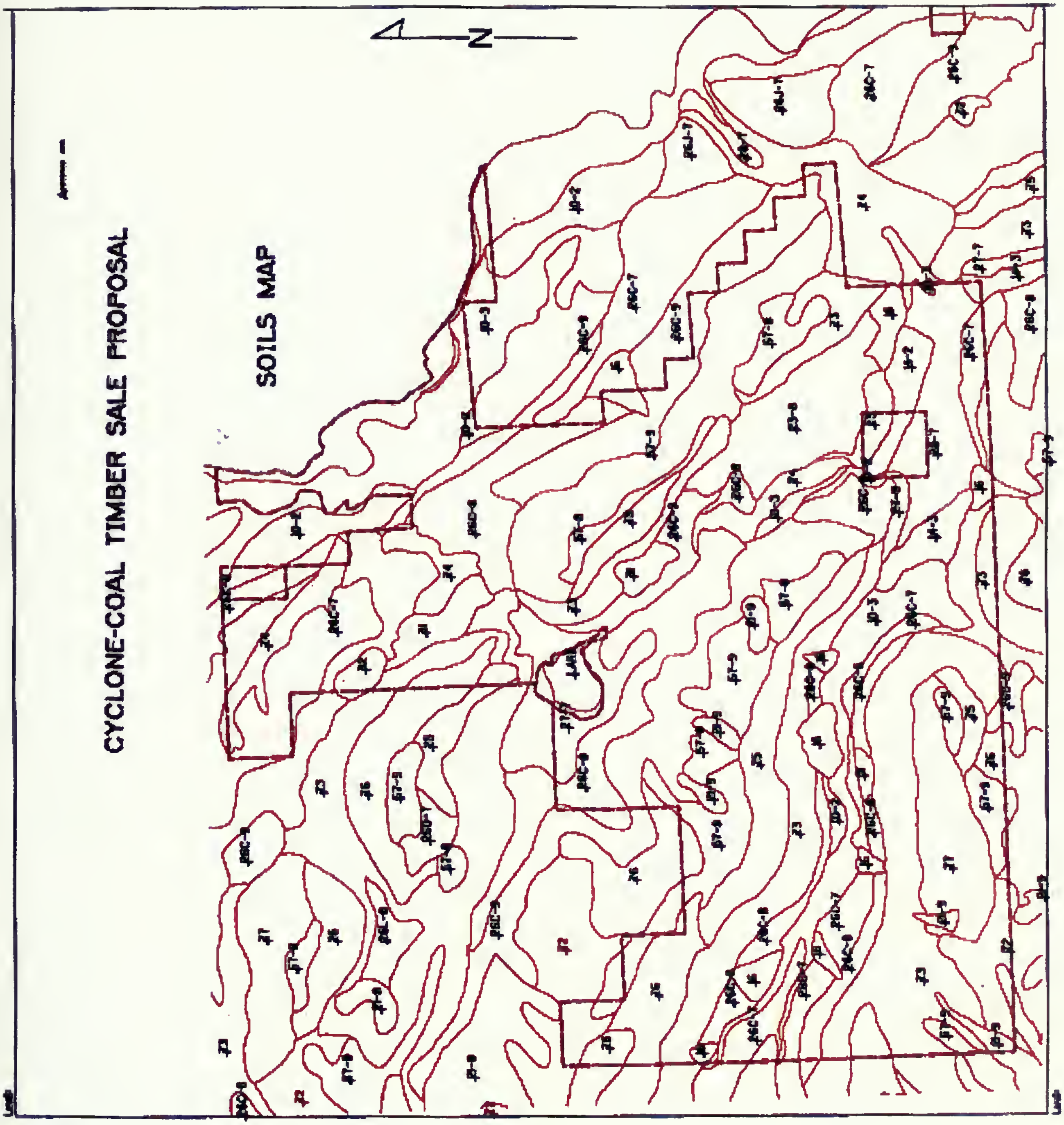
3. Prompt revegetation of disturbed roadside sites would be required. Roads used and closed as part of this proposal would be reshaped and seeded.

APPENDIX B

MANAGEMENT INTERPRETATIONS FOR SOIL TYPES IN PROJECT AREA

Map Unit	Description	Soil Drainage	Road Limitations	Topsoil Displacement & Compaction	Seedling Establishment	Erosion (BareSurface)	Notes
10-2	Alluvial Soils	Poor to Well Drained	Mod to Severe	Severe	Good	Low	Streamside management guides will be applied.
10-3	Alluvial Soils	Poor to Well Drained	Mod to Severe	Severe	Good	Low	Streamside management guides will be applied.
14-2	Lacustrine Deposits	Well Drained	Moderate	Moderate	Good	Moderate	Restrict season of use to avoid displacement
14-3	Lacustrine Deposits	Poor to Well Drained	Mod to Severe	Severe	Fair to Poor	Moderate	Streamside management guides will be applied.
16	Alluvial Fans	Well Drained	Low to Mod	Moderate	Fair	Slight	Deep gravel and shallow surface soils. Beargrass competition common. Avoid displacement.
21-9	Cinque Basin Glacial Till & Residual Soils on 40-60% Slopes	Somewhat Excessive	Mod-Rock on Ridges	Mod/High	Fair, Droughty	Mod/High	Mod. deep coarse soils reduce water and nutrients; south slopes very droughty; cable yard slopes over 45%, or soft track up to 55% slopes.
23-8	Glaciated Mountain Slopes, 20-40% slopes	Well Drained	Low	Moderate (Severe if Wet)	Good	Moderate	Deep, productive soil well suited to tractor operation. Limited dry season of use.
26C-7	Deep Glacial Till 0-20% Slopes	Well Drained	Low	Moderate (Severe if Wet)	Good	Low	Deep, productive soil. Topsoil depth is very important.
26C-8	Deep, Silty Glacial Till 20-40% Slopes	Well Drained	Low to Moderate	Moderate (Severe if Wet)	Good	Moderate	Deep, productive soil. Topsoil depth is very important.
26C-9	Deep, Silty Glacial Till 40-60% Slopes	Well Drained	Mod./High	Mod./High	Good	Mod./High	Deep, productive soil, avg. season of use. Limit soft track skidder to slopes less than 45%.
26L-8	Deep, Fine Glacial Till from tertiary siltstone on 20-40% Slopes	Well to Somewhat Poor	Moderate to High	Mod/High Severe if wet	Good	Moderate to High	Limited dry season of use. Roads require higher standard construction for adequate drainage.
27-7	Glacial Kames and Kettles, 10-20% Slopes	Well Drained	Low	Low	Fair	Moderate	Deep soil, low fertility. Topsoil depth is very important.
27-8	Glacial Kames and Kettles, 20-40% Slopes	Well Drained	Low	Low	Fair	Moderate	Topsoil depth is very important. Moisture stress may affect seedling establishment
28-7	Glacial Outwash, 0-20% Slopes	Well Drained	Low	Low	Fair	Moderate	Topsoil depth is very important. Moisture stress may affect seedling establishment
31	Landslide Deposits, 10-30% Slopes	Poor to Well Drained	High	High	Good	Moderate to High	Deep, productive soil. Not well-suited for building roads. Requires site-specific review for project design of harvest.
32	Landslide Deposits, 35-60% Slopes	Poor to Well Drained	High	High	Good	High	Deep, productive soil. Not well-suited for building roads. Requires site-specific review for project design of harvest.
57-8	Residual Soils & Mod. Deep Glacial Till 20-40%	Well Drained	Moderate	Slight Comp. Mod./Severe Displacement	Fair-Good Droughty on S. Slopes	Moderate	Shallow topsoils; use care during brush piling and scarification on slopes less than 40%. On slopes over 40%, plan cable logging or contour skid trails on 150 ft. min. spacing.
57-9	Residual Soils & Mod. Deep Glac. Till 20-40%	Well Drained	Moderate	Severe Displacement	Fair-Good Dry on S. Slopes	Moderate	Steep slopes limit tractor operation. Use cable or helicopter yarding system.
72	Alpine Ridge Headwalls Slopes > 60%	Excessive	Mod. to Severe (Rocky, Steep)	High Displacement	Harsh site; poor.	Moderate	Low productivity; few trees.
73	Trough Wall Glacial Till & Rocky, Residual Soil Slope > 60%	Fair-Good Droughty on S. Slopes	Mod. to Severe (Rocky, Steep)	High Displacement	Fair	Mod. to High	Steep slopes require cable operation.

Map Unit	Description	Soil Drainage	Road Limitations	Topsoil Displacement & Compaction	Seedling Establishment	Erosion (BareSurface)	Notes
74	Stream Breaklands, Slopes Over 60%	Fair-Good Droughty on S. Slopes	Mod. to Severe (Steep)	High Displacement	Fair, Competition	High	Steep slopes require cable operation. Not well-suited for road building; requires site-specific review.
75	Rock, Residual Soils on Steep Slopes	Somewhat Excessive	Rock	Disp. - High	Fair, Droughty	Moderate	Shallow and mod. deep, very gravelly/ rocky soils. Cable yarding on slopes over 45%, broadcast burn.
76	Geologic Breaklands Slopes Over 60%	Excessive	Severe; Rock Outcrops	High Displacement	Good	High	Steep slopes, rocky soils with common rock outcrops. Cable logging recommended for slopes over 45%. Lop and scatter or excavator pile slash.
77	Geologic Breaklands Slopes Over 60%	Excessive	Severe; Rock Outcrops, Steep	High Displacement	Poor, Subalpine Climate	High	Steep slopes, rocky soils with common rock outcrops. Cable logging recommended for slopes over 45%. Lop and scatter or excavator pile slash.


CYCLONE-COAL TIMBER SALE PROPOSAL
SOILS MAP
N

APPENDIX C

GRIZ ROAD

Grizzly Bear Seasonal Habitat Values near Existing Roads in Coal Creek State Forest

Rich Harris

It is now generally accepted that roads are troublesome for grizzly bears. Open roads (i.e., those receiving some motorized use) particularly degrade the quality of grizzly bear habitat, but even those receiving no motorized use tend to deter grizzlies from using the general area. Thus, closing any open road, or allowing any restricted road to become brushed-in, is beneficial for grizzlies. The choice of which roads to maintain and which to close and/or allow to become brushed-in is complex, and will require multiple considerations. One consideration should be the quality of the underlying habitat through which the road passes. This analysis quantifies grizzly bear habitat quality by road segment within and around the Coal Creek State Forest.

Methods

I used a base map consisting of the May 1997 version of the "Habitat Value" layer of the standardized cumulative effects model (Mace et al, in lit). This map consists of 30 x 30 meter pixels, each scored for to reflect it's Resource Selection Function (RSF) as quantified for grizzly bears using the South Fork Flathead River study area. These indices (ranging from a theoretical minimum of 0 to a maximum of 100) can be thought of as the probability of use by a grizzly bear, given that one lives in the general vicinity. Each pixel has 3 habitat values, corresponding to each of three seasons: spring (1 April - 14 July); summer (15 July - 14 September); and autumn (15 September - 15 November). The RSF values were generated from a logistic regression equation of the dependent variable (female grizzly bear telemetry locations in the South Fork study area) on the independent variables elevation, "green-ness" (a band from TM imagery), and a diversity index of "green-ness" (see maps in project file).

On this base map I overlaid polygons, consisting of 26 road segments buffered on each side by 500m. The choice of the 500m buffer width was justified by data suggesting that this is a typical distance at which grizzly bear avoidance of roads can be quantified (Mace, unpublished data). I delimited road "segments" by intersections and locations of existing gates, or changes in road classification. All roads that can currently be driven by a 4-wheel drive vehicle were examined, regardless of closure status. I did not include within the roads examined those currently mapped, but which are currently brushed in to the point where mechanized work would be required before they could be driven by a 4-wheel drive vehicle.

Habitat values within each polygon were then summed, using EPPL7, for each season. Here, I summarize the data by reporting mean seasonal habitat value for each polygon. The total habitat value is also important, and can be calculated by multiplying the mean value by the acreage in each polygon.

Results

Full results are seen on the paper map. Road segments are numbered (1 -26). Near each, a box shows the acreage within the numbered road segment, and the mean habitat value within the buffered segment for each season. (I'll bring this map to the meeting on June 26, and will leave it with Dave).

Overall, seasonal habitat values were similar among road segments. There were few road segments that stood out as being particularly valuable (or unimportant) relative to others. Thus, closing any one segment of road would generally have an effect on grizzly bear habitat value proportional to its length (or, more precisely, proportional to the area affected, i.e., its buffer). There were some general trends, however, that are worthy of consideration.

In spring, the main (open) access roads generally had higher values than did secondary (generally restricted) roads. Highest values were seen along the main Coal Creek road. The road heading south into the Dead Horse drainage (FS 1693) also had high spring value. The roads on the FNF to the NW of CCSF (in higher elevations) generally had the lowest spring values.

In summer, the restricted road system on Coal Ridge had generally higher values than did most of the main access roads; the FS roads NW of CCSF also had relatively high summer values. The restricted roads on the east slope of Winona Ridge, as well as the open road system in the SE corner of the forest, had generally lower summer values. Autumn habitat values generally paralleled those for summer.

Implications

First, it is important that habitat values be compared only within season, not between seasons. Secondly, while it is true that, viewed within seasons, values are broadly similar, it does not follow that it makes absolutely no difference which roads are maintained as open, which are restricted, and which are allowed to brush-in. Viewed on a scale of 0 to 100, a difference of 45.6 to 60.5 (the minimum and maximum spring values observed in these road buffers) may seem trivial; but bears living in the area don't have a choice of moving to locations with values as low as 0 or as high as 100. They can chose only among locations available to them. Viewed in this light, the latter area would be almost 1/3 more likely to have a bear using it during spring than would the former.

Second, it is reasonable to ask the question: Can one prioritize habitat security for grizzlies among the three seasons, given that the trends often differ? I believe the answer is clearly the following: Spring is the most important, followed by autumn. If habitat security must be compromised during any time period, it makes most sense to do it during summer, when bears have the greatest choice of locations. This prioritization is based on energetic requirements, and mortality risk, and agrees with that suggested by Rick Mace, MDFWP (pers. comm., June 1997).

In general, the road system in the southern part of CCSF overlays habitats of higher quality for grizzly bears than does the system in the north, particularly during spring. Additional closures in this area would be worthwhile.

Road closures have considerable benefits beyond those to grizzly bears. Thus, as we attempt to meet our guidance of not-net increase in proportion of the CCSF exceeding the grizzly bear road density criteria, we can and should consider multiple resources, grizzly bears being one.

APPENDIX D

Categorical Projection Model used in Assessing Old-Growth Attributes Immediately Postharvest in Current Old-Growth Stands that remain "old" following harvest.

Harvest / Current Condition	Postharvest Large Tree	Postharvest Snags	Postharvest Coarse Woody Debris	Postharvest Decadence
Clearcut with reserves				
None	None	None	None	None
Few	Few	Few	None	None
Some	Few	Few	Few	Few
Many/Much	Few	Some	Some	Some
Seedtree with reserves				
None	None	None	None	None
Few	Few	Few	None	None
Some	Few	Few	Few	Few
Many/Much	Few	Few	Some	Some
Thinning from below with reserves				
None	None	None	None	None
Few	None	None	None	None
Some	Few	Few	Few	Few
Many/Much	Some	Some	Some	Some

APPENDIX E

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